Equipping The Marine Corps For Intelligence Fusion

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## EXECUTIVE SUMMARY


**Title:** Equipping The Marine Corps For Intelligence Fusion

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**Thesis:** The current Marine Corps approach to providing responsive fused intelligence to tactical operations can be improved through a number of changes in the systems development process and a distributed collaborative network architecture.

**Discussion:** Central to the issue is recognizing intelligence fusion as an *information management* problem rather than an *information technology* problem. Achieving *knowledge dominance* through intelligence fusion, instead of *information superiority* through more data, will require a number of changes to overcome the identified weaknesses of our current processes. An analysis of the national intelligence community, joint doctrine, and private industry reveal a tendency to provide centralized coordination and sponsorship, with decentralized execution on the battlefield to maximize responsiveness.

The Marine Corps can make adjustments to both the systems development process and intelligence functional sponsorship to better fuse the products of "stovepipe" intelligence disciplines into a coherent and complete intelligence estimate. Among the systems development changes required are the development of an intelligence roadmap to guide budgetary priorities, the return to the functional roots of intelligence by taking the "I" out of "C4I", and the establishment of an intelligence proponancy board. These changes will provide a unity of effort which replaces a natural focus on intelligence *systems* with a focus on fused intelligence *products*.

Equipping the Marine Corps for intelligence fusion also requires a new systems architecture that is designed for distributed fusion. The current Marine Corps approach to intelligence fusion is manually intensive, rigidly controlled from the top, and segregated by individual discipline. MEF intelligence resources concentrate on their primary customer, the MEF commander. This operational level picture of the battlefield, however, may not meet the needs of dispersed tactical maneuver elements. Maximum use of automation for repetitive routines, decentralized collaboration between units, and connectivity to widely dispersed elements are all critical components of a new architecture. Intelligence users must retain the capability to tailor the core intelligence picture to meet their own unique requirements, feed the core picture with "bottom-up" collaboration, and query the supporting intelligence network for greater *depth* of intelligence on the narrow *range* of subjects of interest to the local commander.

**Recommendations:** The Marine Corps must restore strong functional sponsorship to the intelligence field, and change its approach to intelligence systems development. The Marine Corps can build on its existing systems and acquisition programs to provide a distributed collaborative intelligence fusion network, and position itself to leverage emerging technologies in a coordinated manner. The distributed collaborative intelligence fusion network will address not only the current shortfalls in the intelligence architecture, but also the challenges presented by emerging doctrines and technologies.

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# CHAPTER 1

# INTRODUCTION

The United States intelligence apparatus is second to none in the collection of information. In fact, "information superiority" is a key tenet of Joint Vision 2010. Information superiority is the gateway to the operational concepts of dominant maneuver, precision engagement, focused logistics, and full-dimensional protection. "*We must have information superiority*" (emphasis in the original) is fundamental to the entire strategic

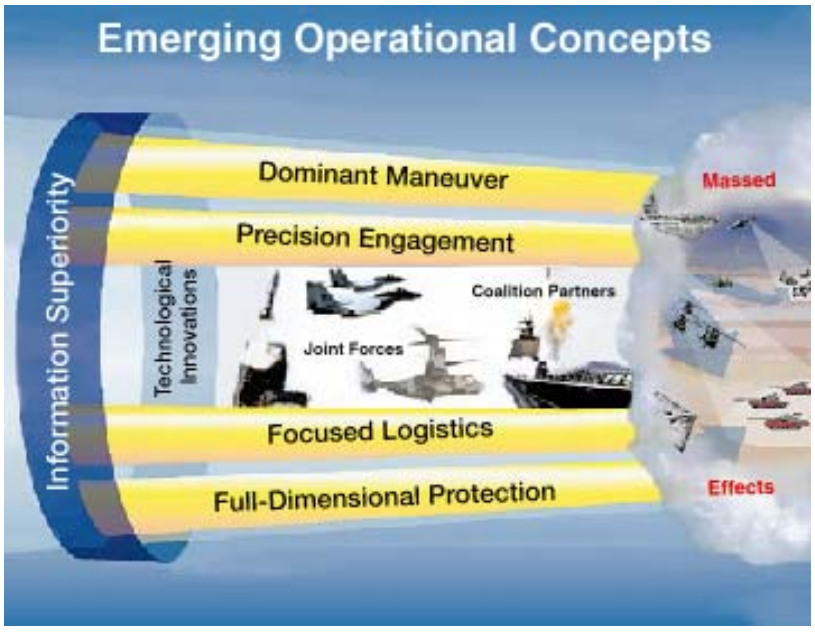


**Figure 1. JV2010 and Information Superiority**

vision of the United States armed forces.[1] Information superiority creates the capability for massed effects from widely dispersed, highly mobile forces; packing lethality and stealth into smaller economical force packages. Yet, the entire *information* superiority premise for Joint Vision 2010 gives rise to a fundamental misconception that may throw intelligence efforts off-course (Figure 1). JV2010 fails to address the requirement for an *information management* capability that matches our *information technology* capacity.

Discerning the difference between *knowledge* and *information* is a critical link missing from the battlefield dominance chain postulated in JV2010. The necessary information management tools, techniques, and procedures to transform this tremendous volume of collected information into usable, reliable intelligence are missing. This lack of focus on the *fusion* aspect of intelligence is a critical vulnerability. Without fusion, information cannot be turned into knowledge. Without knowledge, intelligence is of limited utility. Without intelligence, JV2010 falters.

The Marine Corps has not escaped the temptation to focus on information proliferation instead of fused knowledge. The ability of the Marine Corps to fuse *information* from a host of sophisticated collection systems into *knowledge* must be enhanced. This critical vulnerability is made more worrisome by the emergence of Marine Corps doctrine and warfighting concepts that promise to severely tax our information management capabilities and increase our reliance on sound intelligence fusion. Operational Maneuver From the Sea (OMFTS), in particular, depends heavily on sound intelligence, situational awareness, and knowledge of the battlespace.

[1] Joint Staff, *Joint Vision 2010* (Washington DC: Department of Defense, 1995), 16.

This paper reviews the intelligence fusion environment, analyzes the existing Marine Corps fusion process, and answers the question: "Are we equipped to fight the next intelligence battle?" Both *systems development* changes and a new *systems architecture* are proposed.

It is clear that changes to our security environment and missions also challenge the effectiveness of our traditional *organizations, training,* and *doctrine.* Addressing all of the facets of intelligence training pipelines, intelligence organization, and doctrinal deficiencies, however, is too large a challenge for this limited analysis. Doctrinal, organizational, and training changes are generally beyond the scope of this effort, and will only be included where they have a direct impact on equipping the force.

The Marine Corps can better fuse the products of the various "stovepipe" collection disciplines into a coherent and complete intelligence estimate. This analysis demonstrates that Marine Corps intelligence is not so much "broken" as "unfocused." With the implementation of a focused effort on intelligence fusion, the Marine Corps can move quickly through *information age* ideas, and posture itself for maximum warfighting effectiveness in the *knowledge age*.

# CHAPTER 2

# INTELLIGENCE FUSION ISSUES

Sources of intelligence are varied. An intelligence "discipline" refers to a specific means of gathering information, usually linked by a common signature or element of information being prosecuted. The primary intelligence disciplines exploited by the Marine Corps include Imagery Intelligence (IMINT), Signals Intelligence (SIGINT), Human Intelligence (HUMINT), and Measurement and Signature Intelligence (MASINT). Each discipline takes advantage of its own specialized techniques, processes, and equipment optimized for that discipline. Although each discipline provides a crucial piece of the overall intelligence picture, it is necessarily insufficient by itself. The overall intelligence picture must include information from the other intelligence collection disciplines, as well as economic, geographic, meteorologic, cultural, and political information.

All-Source intelligence fusion, therefore, is the combination of information collected by multiple disciplines into a cohesive and comprehensive intelligence product. Fusion must also be an effective filter to screen out extraneous, redundant, or irrelevant information from distracting the commander. Just as a picture is worth a thousand words, a thousand pictures can be so overwhelming as to be meaningless.

At the operational level, intelligence fusion provides the commander with a comprehensive picture of the battlefield so that he may employ other warfighting functions to maximum effect. Without a comprehensive fused intelligence estimate, it is difficult to focus the other elements of combat power on an operational objective. One field commander of some repute has put it like this, "It is not that one general is more brilliant or experienced than the other; it is a question of which general has a better *appreciation* of the battlefield."[2] In this quote, Field Marshall Rommel clearly establishes the importance not only of good intelligence, but also of intelligence that is fused into a coherent whole. An *appreciation* for the battlefield arises not from simply a descriptive analysis of the terrain, enemy forces and equipment. An appreciation additionally includes insight derived from fusing the elements of this battlefield environment to appreciate its character, the interaction of its elements, and the cause and effect relationships contained within it.

An appreciation is *estimative* as well as *descriptive*. A photographic image of a company of tanks provides meaningful information. Multiple photographic images of the same target add only incrementally to our understanding of the battlefield. A signals intercept of the order for those tanks to attack at a specific time and place provides additional meaningful information. Fused together these two pieces of intelligence provide much more than either discipline could alone. It is this correlation of intelligence disciplines that marks the transformation of information into knowledge, and gives the commander an *appreciation* of the battlefield.

[2] Erwin Rommel, Quoted in Marine Corps Doctrine Publication (MCDP) 2, *Intelligence* (Quantico, VA: Marine Corps Combat Development Command, June 1997), 4.

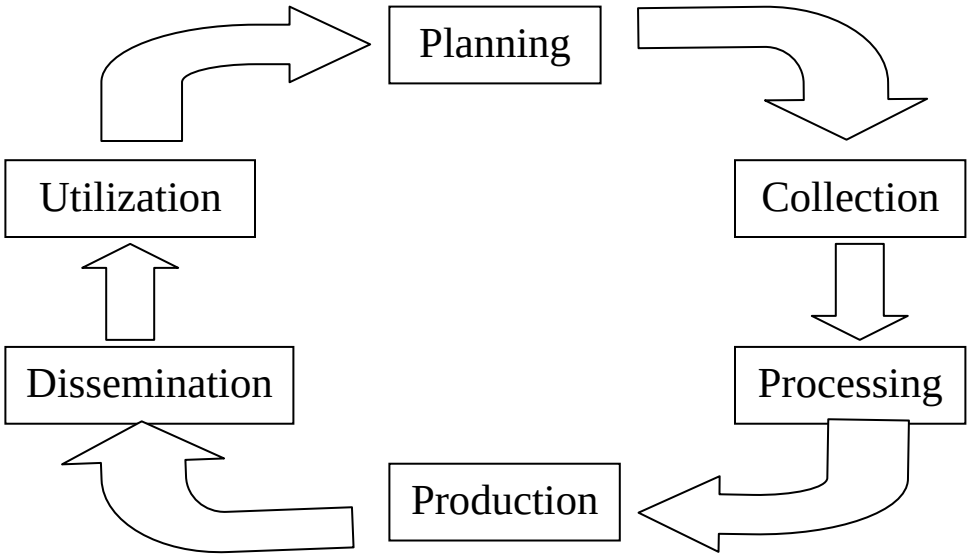


**Figure 2. The Intelligence Cycle**

**Fusion and the Intelligence Cycle**

Without the critical intelligence fusion process, raw information does little but add to the "information overload" experienced by modern commanders. As described in MCDP 2, "Intelligence is the analysis and synthesis of information into knowledge."[3] By its very definition, then, completion of the intelligence cycle requires the synthesis of the individual intelligence disciplines into a fused product. Although fusion is not a separate step in the intelligence cycle (Figure 2), the concepts of intelligence fusion apply in varying degrees throughout.

In *planning* the intelligence effort, fusion precepts should dictate the prioritization of intelligence requirements, the adequacy of individual collection disciplines to meet the most critical intelligence requirements, and the synergistic combination of disciplines employed to best complement each other.

[3] MCDP 2, 8.

In the *collection* phase, intelligence collection tasks must be assigned with consideration for the total fusion effort. Fusion considerations can provide the basis of cross-cueing from one sensor to another thereby maximizing the capabilities of a limited set of collection resources. By maintaining multiple intelligence sources, the enemy may be manipulated into exposure to one collection source as he struggles to avoid exploitation by another.

During *processing and exploitation*, products must be generated that feed an all source, fusion-friendly architecture. This may include common digital formats for imagery, standard message sets for reporting SIGINT targets, etc. A view toward intelligence fusion must be applied to doctrinal employment, training, and systems development to ensure compatibility of processing and exploitation systems.

It is in the *production* phase that the fundamental concepts of fusion are most applicable and most commonly addressed. Intelligence fusion requires the collection, evaluation, and correlation of disparate collected elements of information and their combination into a single intelligence picture. "Production is a process of synthesis - the most important action in developing usable intelligence for the commander."[4]

Separating the "wheat from the chaff" is an equally important aspect of fusion in the production phase. Through careful analysis, each individual discipline can now give meaning and significance of the others. In production, fusion takes the intelligence from the realm of the *descriptive* into the realm of the *estimative*, which is the key to successfully dealing with an intelligent and uncooperative enemy.

*Dissemination* must be complete and automated. Most importantly, dissemination must occur in a format and accessibility that meets the needs of the supported

commander. Dissemination must move beyond the rapid inundation of the user with multiple unfused intelligence reports, and focus on creating an appreciation for the battlefield in the mind of the supported commander.

In *utilization*, the burden lies with the user of intelligence to take advantage of the intelligence picture, and to identify shortcomings that serve as planning direction in the next intelligence cycle. The entire fusion effort must be focused on the utilization step. Ironically, if proper fusion does not occur in the steps leading up to the utilization step, the commander will have to divert his intellectual resources to create his own battlefield picture, instead of planning for successful exploitation of the situation. Thus, even though the intelligence user has the ultimate responsibility for this step, the failure to provide a fused product represents a failure of the entire intelligence cycle.

**Challenges To Intelligence Fusion**

By definition, intelligence is a technical discipline that attempts to achieve clarity out of chaos, and definition out of deception. It is a difficult combination of highly precise technology arrayed against an ill-defined battlefield that defies characterization. Cutting through the fog of war to ascertain the capabilities and intentions of the enemy has been the goal of commanders since the earliest days of conflict. In the last half-century, however, the American intelligence community has been steadily marked by an increasing desire to pit more precise technology against this imprecise task. Although this tremendous investment in technology has brought about an impressive capability, it has led to some new challenges as well.

[4] MCDP 2, 62.

The first challenge is *information overload*. It has become much easier to collect, display, and distribute vast quantities of information. Currently, our *information technology* capabilities are outstripping our *information management* capabilities. The result has been a gradually increasing "noise floor" that can mask critical items of intelligence with a flood of non-essential informational elements.

A second challenge is distribution of the *right products to the right users*. The forward platoon commander can benefit from the same high technology as the Chairman of the Joint Chiefs of Staff, but each may require significantly more *depth* on a narrower *range* of intelligence, and their definition of timeliness may be much different.

The third fusion challenge is the unique *timeline* associated with each individual discipline. HUMINT reports can include information that is weeks old, imagery can be delayed by days, and SIGINT can be real-time and critical. In other scenarios, the timelines can be reversed. Proper fusion ensures that the information from a HUMINT report last week, can be correlated with a picture taken last night, and a signal intercepted in the last ten minutes.

Fourth, a challenge to intelligence fusion is *information flow reversal*. Existing intelligence systems are geared toward top-down dissemination of information that is correlated and processed at higher echelons. Once a unit establishes contact with the enemy, however, the intelligence *user* immediately becomes a primary intelligence *producer*. Small unit leaders and other intelligence users must recognize their critical role in feeding the intelligence picture. Without fusing information from all echelons, the intelligence picture is weakened.

Finally, the increasing sophistication of our technology has also led to an *increasing specialization* among individual intelligence disciplines. Imagery Intelligence, Signals Intelligence, and Human Intelligence, to name but three, have each developed unique collection equipment and specialized exploitation techniques.

**A Lack of Fused Intelligence**

There has been significant documentation of a systematic failure of the Marine Corps intelligence process to provide a fused intelligence picture. A frequently heard pronouncement is "intelligence is broken," often without a specific description of the nature of the breakdown. This attitude pervades the Corps from the platoon leader, frustrated that he cannot see over the next hill, to the Commandant himself, who included the "fixing" of intelligence in his initial planning guidance.[5] It has been postulated that there is a "crisis of credibility" between the operators and the intelligence community.[6] Fundamentally, the "crisis" is an expression of a mismatch of perceptions between producers and consumers of intelligence.

It is no accident that this on-going frustration has come to a head in an era of vastly improved intelligence collection equipment, precision imagery, and the vast improvement in our national/theater agencies and architectures. The intelligence community is now able to provide sophisticated intelligence with more precision than even imagined a decade ago. Intelligence users are aware of many of these products, and wonder why their own questions remain unanswered. There are certainly resource and priority issues behind these frustrations, but another answer is a *lack of fusion.*

[5] Commandant General J. Jones, Commandant"s Planning Guidance, July, 2000.
[6] Colonel Michael E. Ennis, "The Future of Intelligence," *Marine Corps Gazette*, Oct 99, 46.

One intelligence professional indicates that the intelligence community "lacks credibility because the solution lies not so much in producing more or better intelligence as it does in making the intelligence they already have more accessible and usable to the planners and operators."[7] Marine Colonel Ennis, the author of that passage, uses the term "operationalizing" of intelligence to describe the problem. It is a lack of fusion in the intelligence cycle that causes our intelligence to be less than "operational".

After action reports from Desert Shield/Storm reveal the following problems (among others):

- There was a principle shortfall in processing and dissemination of combat information and all source intelligence of immediate tactical value to subordinate commanders throughout the MEF.
- The MEF did not provide fused intelligence adequately tailored to the needs of the tactical commander.
- Intelligence products lacked a clear analysis of enemy activity and reporting was primarily focused on the operational vs. the tactical level.
- Since the Marine Corps does not have a fully developed service intelligence center, MARCENT had to rely on other service intelligence centers for support.
- The MEF was burdened with a staggering volume of information and did not have the personnel, data processing, or communications assets to adequately process and disseminate that information.[8]

Even after Desert Shield/Storm, Marine ground intelligence has been criticized as being "configured for attrition warfare and the predictable conventional adversaries of the past."[9] When presented with an asymmetric adversary, such as the Somali clans (1992-

[7] Ennis, 46.
[8] Marine Corps Research Center, "Intelligence Operations in Southwest Asia," Research Paper #92-0008, July 1991, xi.
[9] Captain Drew E. Cukor, USMC, *Marine Ground Intelligence Reform: How To Redesign Ground Intelligence For The Threats of the 21st Century*, Master"s Degree Thesis (Naval Postgraduate School, December 1997), 25.

1995), the existing hierarchical organization for intelligence displayed weaknesses at the *low* end of the conflict intensity spectrum as well. This class of threat, with decentralized decision making, low technology, and human networked operations, can not be easily monitored and tracked using sophisticated sensors or standardized threat templates.

**Emerging Doctrine and Concepts**

As we move into the 21st century, the fusion challenge will likely become even greater. The intelligence community will no longer be able to rely on "classic" intelligence indicators and templates when challenged by quasi-governmental criminal enterprises, narco-terrorists, and networks operating independently from government sponsorship. These threats are agile, adaptive, unconventional organisms that understand US capabilities and weaknesses. The fusion of battlefield military intelligence with diplomatic, economic, and political intelligences may become a key requirement for our future operations.

Emerging operational doctrines such as Operational Maneuver From The Sea (OMFTS) will also pose tremendous challenges to the existing intelligence systems architecture, and will make rapid multi-disciplinary intelligence fusion a must. The final report of the OMFTS working group, entitled *21st Century Warfighting*, explicitly notes the dependence of dispersed maneuver elements on highly effective fused Intelligence Surveillance and Reconnaissance (ISR) capabilities:

> To achieve an enhanced level of situational awareness, the OMFTS MAGTF requires a highly effective ISR capability that integrates organic and external resources…[it] must be quickly and easily accessible to the commander and his forces as in integrated component of the Common Operational Picture/Common Tactical Picture (COP/CTP). The COP/CTP must be capable of fusing data from multiple sources, including organic

> sensors and databases, and it requires the capability for constant and rapid update.[10]

Some of the noted intelligence challenges of the OMFTS environment are clear.[11] OMFTS requires scaleable intelligence reporting, layered ISR to provide overlapping coverage, and some modicum of self-sufficiency in tactical collection resources (for individual maneuver elements) that complements MAGTF and external sensors. It poses considerable challenges to the existing intelligence order and a disconcerting mandate to reduce the footprint of our intelligence systems while simultaneously increasing our reliance on timely, fused intelligence products from across disciplines. Operations will be launched from over the horizon, with limited organic intelligence collection capabilities. Tempo will increase the demand to provide both enemy and environmental intelligence simultaneously and rapidly without an intelligence pause. This increase in demand must be met, primarily, from intelligence fusion elements which are either sea-based or otherwise located far from the scene of battle.

The OMFTS working group takes particular care to recommend "a robust, continuous, automated, mechanism to task, receive, process, prioritize, analyze, *fuse*, and disseminate intelligence information from all sources, both organic and external."[12] How to meet this challenge becomes a central issue in the effort to build a responsive intelligence fusion architecture.

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[10] OMFTS Working Group Final Report, *21st Century Warfighting* (Quantico, VA: Marine Corps Combat Development Command, Autumn 1998), III-1.
[11] Multiple sources exist. A good discussion is provided in LtCol Norman C. Davis, "Intelligence and OMFTS: Organizing for the Future," *Marine Corps Gazette*, October 1999, 48.
[12] OMFTS Working Group, III-4.

## Chapter Summary

The problem of recognizing intelligence fusion as an *information management* problem rather than an *information technology* problem exists even at the highest levels of the Department of Defense. The perception that "intelligence is broken" that exists at many levels within the Marine Corps can be significantly rectified by implementing some intelligence fusion measures throughout the intelligence cycle. The simultaneous convergence of a "crisis in credibility," an incredible advance in technology, and the evolution of a new operational concept has created a challenging environment for intelligence professionals. This environment mandates a fresh look at our ability to conduct cross-discipline intelligence fusion across the spectrum of conflict.

# CHAPTER 3

# THE INTELLIGENCE FUSION ENVIRONMENT

Analysis of Marine Corps intelligence fusion benefits from an understanding of the fusion processes utilized by the remainder of the Intelligence Community (IC). Marine Corps intelligence operations must conform to mandated standards and directives in order to contribute to and benefit from the larger national intelligence picture. Also, by evaluating the fusion methodologies that are in place at echelons higher than the Marine Corps, we can reap lessons for our own fusion methodologies.

## Intelligence Fusion at the National Level and the Department of Defense

There are some key lessons to be gleaned from national intelligence architectures. Just as the Marine Corps has systemic issues with sensor fusion and debilitating specialization, so does the national intelligence community. At the national level, each of the intelligence disciplines is conducted and sponsored by a unique agency, with responsibility for fusion occurring only at the highest levels. At the national level, the three primary disciplines of HUMINT, IMINT, and SIGINT are sponsored primarily by the Central Intelligence Agency (CIA), the National Imagery and Mapping Agency (NIMA), and the National Security Agency (NSA).

Although the Director of Central Intelligence (DCI) retains coordination responsibility for the entire intelligence establishment, each of the arms of the

intelligence "machine" operates with significant functional independence. Because each intelligence discipline has a primary agency advocate, there is significant potential for "stove-piping" of information and fierce protection of roles and missions for budgetary advantage and primacy of influence.

There is less budgetary advocacy for intelligence *fusion*, however, since there is not a sponsoring agency specifically for intelligence fusion. Thus, congressional oversight is less likely to address fusion issues *among* disparate disciplines, as fiscal leverage is not as easily applied at the seams between government agencies. This splintering of the collection and analysis missions among intelligence agencies has caused difficulties in conducting intelligence fusion:

> Organizationally, we are not set up to cull critical facts and fuse them into analytic product. In reality, fusion is all about context, and the notion of dividing the labor represents the destruction of that context. In the end, the lack of fusion and integration capability means that the [Intelligence Community] whole is substantially less than the sum of its parts.[13]

The national establishment now runs on the principle of decentralized collection and processing, but centralized production and dissemination. This principle is also applied by the intelligence establishment within the DOD. The Defense Intelligence Agency (DIA) has become the primary fusion coordinator and intelligence support advocate for DOD. The DIA maintains significant oversight over collection resources and programs, establishes DOD intelligence policies, and serves a coordination role for issues that exceed individual service capabilities (such as medical intelligence, missile and space intelligence, etc.)

[13] Russ Travers, "The Coming Intelligence Failure," *Studies in Intelligence*, Volume 40 #2, 1996, 25.

There are parallels to be noted between these national level entities and the Marine Corps intelligence mission. Despite the existence of subordinate elements retaining the intelligence collection resources, there is a mandate for a single controlling coordinator to provide the top level commander with a fused intelligence product. This could be the National Command Authorities, the Joint Staff, or the commander of a Marine Expeditionary Force. Although the desire to be responsive to a number of tactical users is important, a Marine Corps intelligence fusion system must retain a centralized primary component that is responsive to the top level commander. Likewise, it is clear that disparate collection entities can be semi-autonomous, while coordinated by a central coordinating authority. The national and DoD level systems demonstrate that it is possible to have centralized *coordination* with decentralized *control* and responsiveness.

**Intelligence Fusion in Joint Doctrine**

The picture is similar at the operational and tactical level, as proscribed in joint doctrine. Joint doctrine attacks the problem of providing responsive intelligence support to Joint Force Commanders (JFCs) by a concerted attempt to achieve unity of effort across the intelligence community in support of a JFC. Joint doctrine specifically mandates an all-source fusion approach to intelligence support to joint operations:

> Information and intelligence from all sources… must be evaluated, correlated, and integrated into products that present the most complete, accurate, and objective views possible. Joint operations in particular require complete and composite views of the situation and an adversary's land, sea, air, and space forces.[14]

[14] Joint Publication 2-0, *Joint Doctrine For Intelligence Support to Operations*, (Washington DC: Department of Defense, May 1995), IV-12.

The Joint Intelligence Centers are the primary intelligence organizations providing support to joint warfighting at all levels.[15] The JIC takes the products from a host of decentralized collection resources, and fuses them into singular products for the supported commander in theater. Conceptually, the theater JIC not only streamlines the production and dissemination processes, but also provides stable geographic area expertise from which to draw. The theater JIC provides a scalable response capability through Joint Intelligence Support Elements (JISE) that can forward deploy with supported joint forces.

Information technology forms the other pillar of joint doctrinal intelligence support.[16] The national intelligence architecture is designed for a fundamentally *collaborative* approach to intelligence fusion. This reflects the idea that intelligence must not be governed by a strict hierarchical dissemination architecture. Instead, intelligence must be rapidly shared up, down, or laterally, with no bureaucratic impediments to time-sensitive sharing of knowledge:

> Automated processing and seamless connectivity at all levels allow intelligence analysts at all levels access to imagery and multiple data bases while concurrently producing intelligence products in response to specific mission requirements. This up, down, and across echelon interface among strategic, operational, and tactical intelligence organizations is the backbone for joint intelligence dissemination.[17]

There are clear lessons to be extracted from the joint intelligence architecture. A centralized coordinating agency can take advantage of information technologies to provide responsive intelligence support to joint elements without strict adherence to a

[15] Joint Pub 2-0, VII-7.

[16] Doctrinally, the Joint Intelligence Centers extend their reach to JFC's by the Joint Deployable Intelligence Support System (JDISS), via the Joint Worldwide Intelligence Communications System (JWICS). JDISS and JWICS are doctrinally mandated system requirements for advanced networking technologies, multimedia services, and data sharing formats for intelligence forces. Conceptually, JDISS covers *what* is being transmitted, while the JWICS covers the transmission *means*.

linear, top down dissemination approach. This same principle can be applied to a Marine Corps fusion architecture. By leveraging information technology, products and tools that are provided for the commander can be made available to and tailored by subordinate commanders. Subordinate elements must have access to *up, down, and across echelon* resources, and must be allowed to collaborate with intelligence resources regardless of the level of command.

**Intelligence Fusion in the US Army**

The U.S. Army is making a large-scale investment in preparing itself for information dominance in this century. One of the recurring themes is the concept of Battlefield Visualization, a concept that implies the ability of commanders to *visualize* their battlespace in terms of time, space, combat power, and purpose. Battlefield visualization has already taken doctrinal root as a fundamental staff responsibility in FM 101-5, Staff Organization and Concepts:

> Battlefield visualization is the process whereby the commander develops a clear understanding of his current state with relation to the enemy and environment…It is critical to mission accomplishment that commanders have the ability to visualize the battlefield. [18]

The Army hopes to achieve battlefield visualization via a suite of interoperable and flexible hardware and software known as the Army Battle Command Systems (ABCS). The intelligence segment for the ABCS, and the primary tool for deployed Army intelligence activity is the All Source Analysis System (ASAS). Just as the JIC serves as the point of entry for joint theater intelligence, the ASAS consolidates organic and external intelligence inputs into a single system.

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[17] Joint Pub 2-0, VII-3.
[18] Field Manual (FM) 101-5, *Staff Organization and Concepts* (Washington, DC: Department of the Army, June 1995), 1-3.

The Army also maintains a single Product Manager for Intelligence Fusion. With a single point of contact for fusion systems development, the Army is able to take control of disparate intelligence system development programs to ensure commonality and interoperability. The Army recognizes the liability posed by large-footprint, corps level systems and continues efforts to downsize their intelligence fusion systems.

One of the more exciting Army developments is the Tactical Exploitation System (TES). The TES is a HMMWV-mounted intelligence processing system that combines the functionality of a number of stovepipe systems into a common fusion processor.[19] The TES can serve as a multi-disciplinary fusion center that has imbedded SIGINT, IMINT, and HUMINT capabilities. In addition, the system can easily be expanded to include UAV control/processing, JSTARS Image Processing Facility operations, communications support, and other functions. The system has turned-in stellar performance in recent joint experiments, and is being considered for procurement by the U.S. Air Force as well.[20]

The Army's successes in intelligence systems development point out the advantages of unity of effort in the systems development process. They also amplify the desirability and feasibility of building modular applications to a common hardware baseline. The Marine Corps could modify its own disjointed systems development approach to gain some of these same advantages.

[19] High Mobility Multi-purpose Wheeled Vehicle.
[20] George I. Seffers, "U.S. Army Intelligence Processing System Ready To Go," *Defense News*, 27 September 1999, 6.

**Intelligence Fusion in the Private Sector**

The challenges faced by military intelligence planners are not unlike the challenges of many commercial entities faced with a global competitive environment. In the early 1990's American industry began to make fundamental changes in order to remain competitive in a global environment. Centralized bureaucracies were eliminated, and replaced with decentralized networks. Business processes and organizational models were reengineered to leverage the underlying intellectual processes. More businesses have become *knowledge-based* enterprises, where assessing the forces of the market environment and the competition has become central to success on the global corporate battlefield.

Arthur Anderson Worldwide (AAW) and McKinsey & Co. are knowledge-based enterprises, using the intellect of their individual consulting teams to attack business problems in widely scattered locations. When a consulting team "deploys" for operations with a unique customer "maneuver element," they are never far from an electronic inter-link that allows caseworkers to create virtual groups around the needs of customers.[21] The result is a distributed intellect, where the knowledge available to each cell grows exponentially with the experiences of the network as a whole. Although a centralized coordination effort is necessary to support the activity, there is no attempt to centralize management and control of the dialogue that takes place on the network. This is directly counter to the bureaucratic tendency to respond to overload by increasing centralized control and carefully controlling information flows. As a response to a networked threat environment (gangs, clans, terrorist groups, rebel factions) this distributed enterprise

[21] Cukor, 169.

network can react much faster than the centralized model instituted in the Marine Corps today.

Consulting firms are not the only ones that are harnessing distributed networked systems for knowledge generation. Technology industry producers use collaborative networking to solve complex problems and to keep abreast of the competition. Retail chains rely on decentralized distributors to quickly make market place adjustments to fluctuations in customer demand. Sales trends are monitored, assessed, and quickly addressed by the intelligence generated and shared by distributed networks. As a result, resources are focused on consumer demand, with a minimization of inventories.

The parallels for intelligence fusion, dissemination, and planning are clear. A centralized intelligence bureaucracy that does not collaborate with distributed forward elements cannot adapt quickly enough to the requirements of tactical commanders. Centralization provides mass to the fusion effort and serves a sponsorship role, but collaboration with commanders in contact with the enemy is central to making it work. Centralized planning and top-down production did not work well for the Soviets, did not work well for Wal-Mart, and is not working well for the Marine Corps either.

**Chapter Summary**

There must be a *fusion* sponsor to provide coordination and focus for the overall fusion effort. This coordination and focus is required for both intelligence products, and resource sponsorship. Without it, there is a natural tendency toward focusing on stovepipe intelligence *systems* rather than fused intelligence *products*. In resource sponsorship, a unity of effort in tying together all elements of the overall intelligence picture makes the acquisition system and the overall intelligence architecture more

responsive. Operationally, the fusion sponsor can apply the principle of *mass* to the generation of a core intelligence picture that serves as the baseline for shared battlespace awareness among supported users. The fusion sponsor not only acts as a filter to spare supported commanders from information overload, but also provides a point of entry for supporting theater, joint, and national intelligence assets.

While the centralized sponsorship of the fusion effort is important, the decentralized collaboration between supported units and the fusion sponsor may be even more critical. A centralized bureaucracy cannot produce a purely "top-down" intelligence picture that is responsive to the needs of distributed intelligence users. Intelligence users must retain the capability to tailor the core intelligence picture to meet their own particular requirements. Distributed users must be able to feed the core picture with "bottom-up" collaboration; as well as query the supporting intelligence system for greater *depth* of intelligence on the narrow *range* of subjects of interest to the local commander.

# CHAPTER 4

# USMC INTELLIGENCE ORGANIZATIONS

This chapter briefly reviews the organic Marine Corps intelligence mission, the organizations that have been formed to meet this mission, and the equipment used by Marines to provide a fused intelligence product. Marine Corps intelligence organizations have a requirement not only to prepare an organic tactical assessment but also to access and fuse other sources of intelligence into a tactical appreciation for the battlefield. Marine Corps intelligence architectures are designed to meet the special intelligence requirements of expeditionary Marine forces:

> Marine Corps intelligence focuses on tactical intelligence, which is the level of intelligence Marines need, generate, and use most often. However, in order to operate effectively, Marine forces require ready access to operational and strategic intelligence, as well as tactical, to comprehend the larger situation and provide appropriate context for the development of tactical intelligence products.[22]

## Marine Corps Intelligence Organization

The relatively small Marine Corps intelligence community must meet the wide range of intelligence requirements of the MAGTF Command Element (CE), the Ground Combat Element (GCE), the Aviation Combat Element (ACE), and the Force Service Support Group (FSSG). Each of these elements has a different area of concentration on the battlefield, and each needs a distinct product to support his mission. Tying the

intelligence support for multiple disciplines and for these disparate missions into a cohesive intelligence architecture is a significant challenge. The focus of this analysis will be on Marine Expeditionary Forces (MEFs), since it is at this level that all the organizations of the intelligence architecture are represented. Smaller Marine Air Ground Task Forces (MAGTFs) are supported by the same principles as those used to support the MEF with detachments serving the role of their parent organizations.

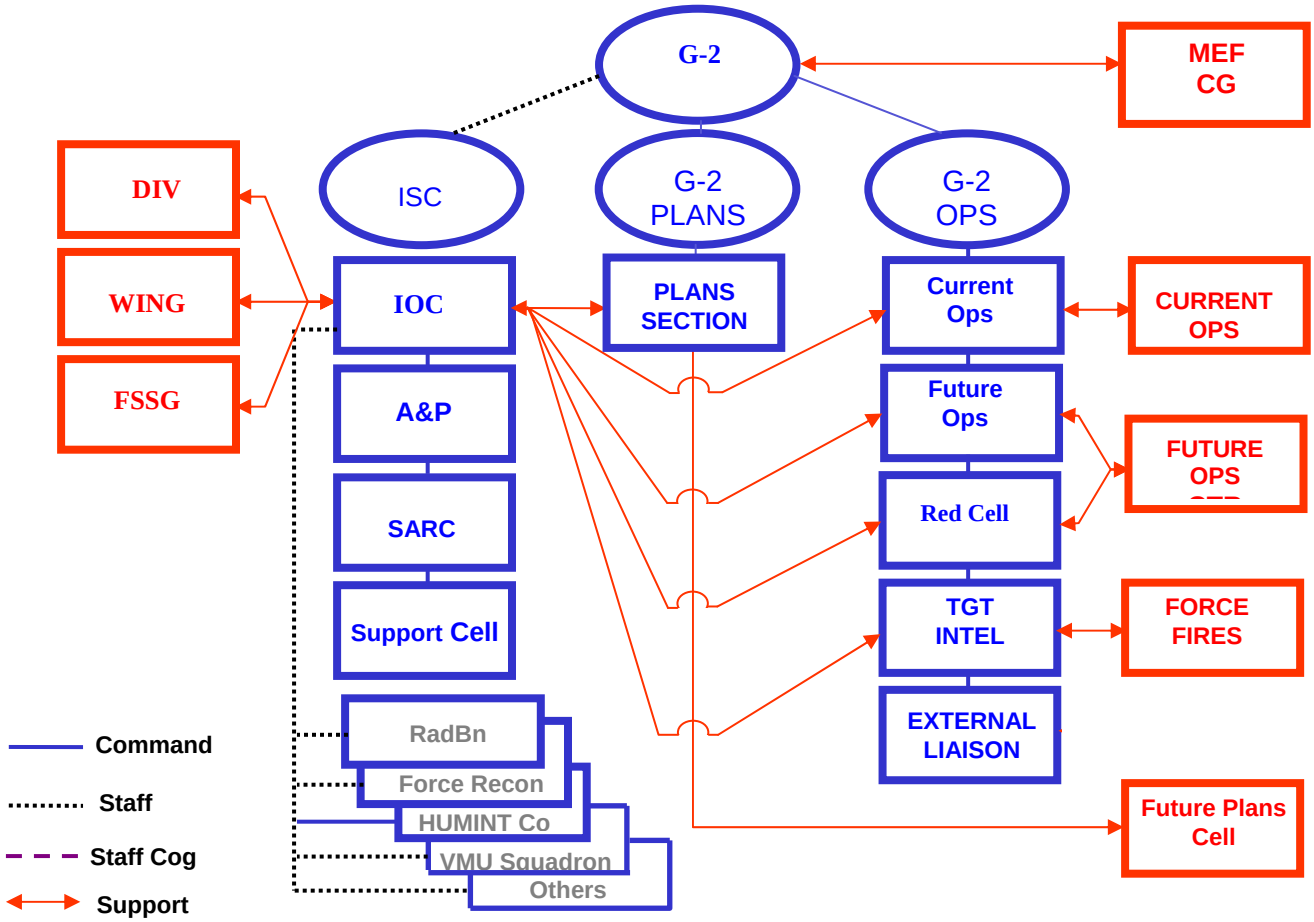


**Figure 3. Intel Ops C2 and Intel Flow**[23]

[22] MCDP 2, 52.
[23] Taken from a briefing by Maj Emile Sander, USMC, "MAGTF Intelligence & Intelligence Battalion Concept of Employment," given to the USMC G-2 Conference, July 1999.

MEF intelligence organization revolves around the relationship between the supported commander, coordinated by the unit G/S-2, and the supporting Intelligence battalion commander or his representative. Figure 3 shows these relationships. The commander, through the G-2, establishes intelligence priorities, conducts intelligence planning, and represents the intelligence "machine" in the current operations center, future operations cell, and on the operational planning team. The Intelligence battalion, on the other hand, supports the G-2s by providing a fused all-source intelligence product. The intelligence battalion commander establishes the Intelligence Operations Center (IOC). It is the IOC that serves as the nominal fusion hub for the supported MAGTF.

The organization and equipment inside the IOC is the heart of the fusion challenge. That challenge is created by the disparate elements that are typically assembled to form the IOC. The Analysis and Production (A&P) Company sources most of the Marine All-source Fusion Center (MAFC) within the IOC, as the A&P Company is the primary all-source analysis and production element of the MEF.[24] Within the IOC, however, are miniature analysis and fusion elements representing each collection discipline. The Radio Battalion-provided Operational Control and Analysis Center (OCAC), the Surveillance and Reconnaissance Center (SARC), the HUMINT Company Command Post (CP), and other supporting intelligence units all reside under this single wide roof. The intelligence battalion commander has the responsibility to plan, coordinate, and integrate the products of these distinct and varied elements into a single fused intelligence product.

[24] Marine Corps Warfighting Publication (MCWP) 2-12, *MAGTF Intelligence Analysis and Production* (Quantico, VA: Marine Corps Combat Development Command, July 1999), 1-13.

Understanding the various components of the all-source picture is key to understanding the linkages between them. The functional proponancy for each of these disciplines during the combat development process typically results in the fielding of equipment that is meant to interoperate, yet arrives at different times, each with its own unique training and support plans. Among the greatest challenges to the MEF intelligence architecture is the accommodation of this "great number of disparate systems that must fall-in on a seamless, integrated architecture, and new systems that keep arriving without a CONOPs for integration."[25] Much of a new system's CONOPs must be derived from experience, so it may not be realistic to expect new systems to seamlessly integrate into a MEF's intelligence architecture from the beginning. It is not fair, however, to lay the entire burden of system integration at the feet of the end-user.

**Fusion, Imagery Intelligence (IMINT) and Topographic Information**

The "eyes of the commander" are provided by IMINT. The rise of imagery to prominence was demonstrated both in Desert Storm and in recent Balkan operations. Imagery comes from a variety of sources, both organic and external to the MEF. The Imagery Interpretation Platoon (formerly the Force Imagery Interpretation Unit) processes and exploits imagery.

External to the MEF are theater and national assets that respond to a number of joint, national, and theater imagery systems. The point of entry for national imagery into the Marine Corps system is the Joint Service Imagery Processing System (JSIPS), which provides image processing, databasing, and distribution service. The CONUS-based JSIPS is connected to the deployed MEF by the Tactical Exploitation Group (TEG) over

[25] I MEF G-2 Intelligence Information and Systems Architecture briefing, Summer 1999.

direct satellite, JWICS, or other SIPRNET connectivity. The forward-deployed, HMMWV-based TEG maintains an Image Product Library (IPL) server, which locally hosts imagery and image products for the area of interest of the MAGTF. The MAGTF also receives external imagery from the theater JIC and other sources. Most imagery products are transmitted in standardized formats, with standard compression schemes that make them usable on a wide variety of platforms. Distribution for imagery products, however, depends heavily on organic communications pipes. Figure 4 illustrates imagery information flow into the MEF.

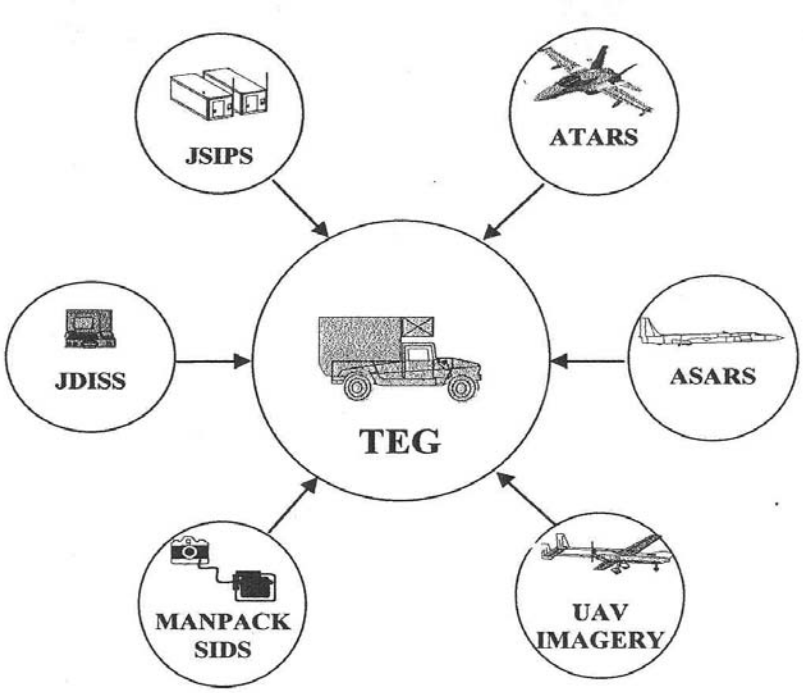


**Figure 4. Imagery Intelligence at the TEG[26]**

For organic imagery, standardized digital imagery products are processed primarily either through the Unmanned Aerial Vehicle (UAV) squadron via their Remote

[26] Marine Corps Systems Command, *Near Term Intelligence Systems Architecture* (NTISA), September 1999, 3-9.

Receiving Unit (RRU), or through the TEG. The TEG serves locally as a ground receiving station for the ATARS imagery pods transmitting from the F/A-18D aircraft. Imagery is also received from reconnaissance units employing the Secondary Imagery Distribution System (SIDS).

**Fusion and Signals Intelligence**

The "ears of the commander" are provided by SIGINT. Signals Intelligence is "intelligence gained by exploiting an adversary's use of the electromagnetic spectrum with the aim of gaining *undetected* firsthand intelligence on the adversary's intentions, dispositions, capabilities, and limitations."[27] Since SIGINT sources are easily denied once monitoring is detected by the enemy, SIGINT requires special processing, handling, and dissemination, complicating fusion with other information.[28] Signals Intelligence is primarily performed by the VMAQ squadron (aviation) or the Radio Battalion (ground).

Within the ACE, the VMAQ conducts its own SIGINT operations using the EA-6B aircraft as its primary collection platform, and the Tactical Electronic Reconnaissance Processing and Evaluation System (TERPES) as the primary processing system. Although the host EA-6B aircraft is capable of conducting ELINT/COMINT/EA missions in support of the ground campaign, TERPES output is almost exclusively focused on providing ELINT support to the ACE.[29] TERPES has its own national intelligence database connectivity, its own analysts, and a dissemination routine within the squadron and the rest of the ACE. It has a limited fusion capability for collected

[27] Marine Corps Warfighting Publication (MCWP) 2-15.2, *Signals Intelligence* (Quantico, VA: Marine Corps Combat Development Command, February 1999), 1-1.
[28] SIGINT is categorized by NSA as Special Compartmented Intelligence (SCI) by United States Signals Intelligence Directive (USSID).
[29] Electronic Intelligence (ELINT) is collected by the transmissions of non-communications emitters such as radars. ELINT and COMINT are subsets of Signals Intelligence.

mission data, national database information, national broadcasts, imagery, and mapping capability.[30] Because of its focus on ACE operations, the TERPES is often overlooked as a very capable contributor to the MEF's all-source fusion effort.

Figure 5 portrays some of the key elements of the Marine Corps ground SIGINT architecture, all of which are tied together at the SIGINT single-source center for fusion, the Operational Control and Analysis Center (OCAC). The Technical Control and Analysis Center (TCAC) is the hardware/software suite that serves as the hub of the OCAC facility.

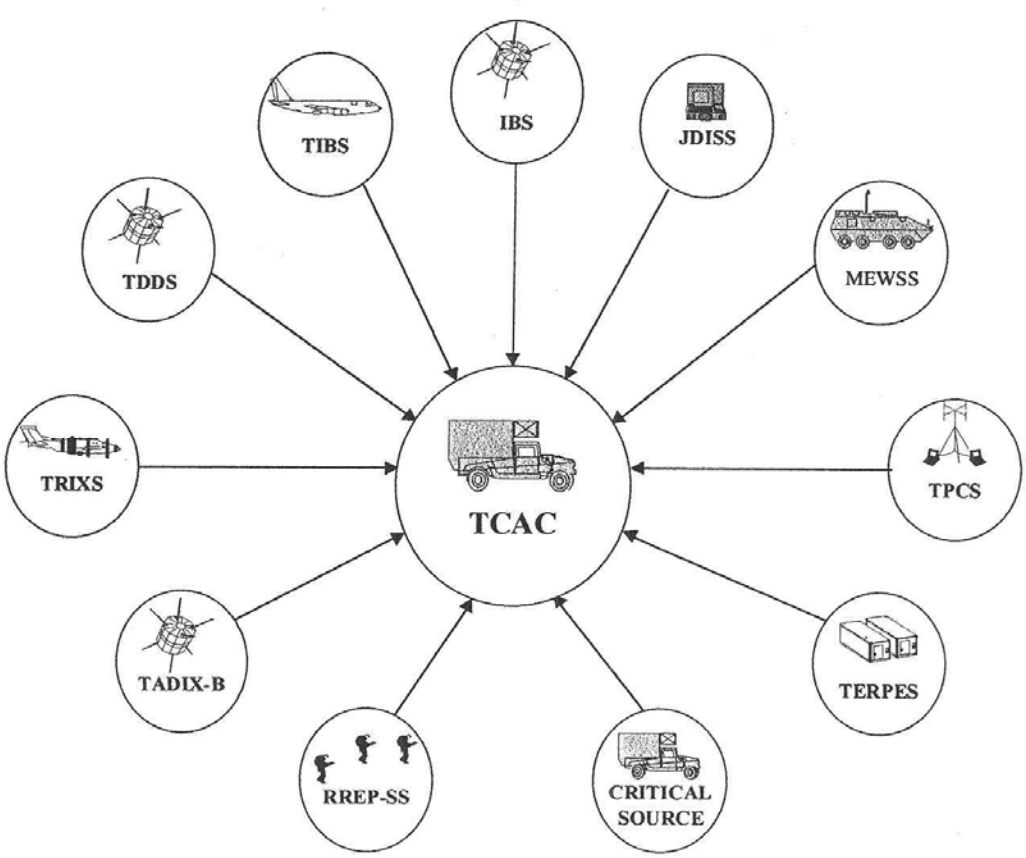


**Figure 5. TCAC SIGINT Fusion[31]**

[30] CWO Bruce Vickers, USMC, TERPES System Project Officer at Marine Corps Systems Command, interview by author, 4 October 1999.

SIGINT operators attending a variety of man-packable, team-portable, and vehicle-mounted collection systems, manually prepare reports in standard message formats, and digitally transmit them to the TCAC database using organic communications assets. Processed SIGINT is routed to the MAFC via the OCAC. The OCAC also receives and processes externally generated reports from national and theater SIGINT collection platforms via the Joint Tactical Terminal (JTT). It is the OCAC, not the MAFC that processes, analyzes, produces, and disseminates SIGINT derived information.[32] Both the SCI classification and the specialized analysis requirements of SIGINT necessitate this relationship. The result is a SIGINT fusion cell that is *collocated* with the AFC, but is not necessarily an *integrated* one.

**Fusion and Human Intelligence (HUMINT)**

HUMINT is an important element that often provides context for the rest of the intelligence picture:

> Humint was instrumental in the…success in Somalia and will remain the most important intelligence discipline in low intensity conflict…Humint requires extensive storage and use of data, fusion of information, correlation, cross-checking, etc.[33]

HUMINT reports offer a wide variety of information, from general "morale of forces" to the timing of specific events. This timing and often generalized nature make it difficult to integrate it into the fused battlefield picture. Worse yet, the high volume of HUMINT reports in some scenarios and the individual attention required to process each report can overwhelm operators and analysts. As with the other disciplines, specialized HUMINT analysis must be applied prior to integration into the rest of the threat picture.

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[31] NTISA, 3-5.
[32] MCWP 2-15.2, 3-2.

"HUMINT is not broken, it is just not integrated."[34] Unlike other collection disciplines, HUMINT often does not contain quantified parameters that can be used to populate a database, so it does not lend itself well to automated correlation and fusion routines.

The Marine Corps organization for HUMINT is another stove-piped collection and processing architecture that has evolved from a separate functional sponsorship. HUMINT is primarily collected by Interrogator/Translator Teams (ITT's) deployed in support of tactical units or to Enemy Prisoner of War (EPW) compounds. The CI/HUMINT Automated Tool Set (CHATS) provides the connectivity for data reporting of HUMINT information over organic radio systems. Many HUMINT reports are not reported over data networks at all, because they are processed manually.

HUMINT collection often provides contextual information that "shades" the rest of the intelligence picture. It often reveals general sentiments, allegiances or cultural biases that may be just as important as more quantifiable elements of information. This "shading" of the intelligence picture must be part of any intelligence fusion architecture, even if it does not lend itself to a map overlay or automated icon. An automated mechanism to correlate HUMINT reports with other disciplines is necessary as part of an overall fusion solution. The ability to automate and distribute this input capability may be the kernel of an automated SARC tool-set that would also support reconnaissance and combat reporting contributions to the intelligence picture. The other HUMINT sources of reconnaissance and combat reporting will be addressed later in this chapter.

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[33] Maj Robert Farmer, USMC, "Improving the Intelligence Analysis System," *Marine Corps Gazette*, April 1995, 36.

[34] Maj Phil Cole, USMC, CI/HUMINT Systems Project Officer at Marine Corps Systems Command, interview by author, 14 September 1999.

**Fusion and Measurement and Signals Intelligence (MASINT)**

"MASINT is intelligence gathered by technical instruments such as radars, passive electro-optical sensors, radiation detectors, and remote ground sensors."[35] On the ground, the principal Marine Corps organization for MASINT is the Sensor Control and Management Platoon (SCAMP). This unit coordinates and oversees the employment, monitoring, and recovery of remote sensors that collect thermal, vibrational, acoustic, or visual information. These sensors are monitored remotely by the Tactical Remote Sensor System (TRSS) control facility. Intelligence reports from this MASINT source take the form of a standardized message, which is passed to the IOC and manually processed.

In the air, the Marine Corps establishes connectivity to the JSTARS airborne synthetic aperture radar via the JSTARS Common Ground Station (CGS) employed by the MEF. The JSTARS aircraft transmits Moving Target Indicator (MTI) reports that can be used to create tracks and location data for large moving objects on the battlefield. These MTI's can be plotted and displayed at the CGS, and forwarded to the IOC for integration into the overall intelligence picture. The JSTARS and CGS together form a large, expensive, high technology collection and reporting system for a single MASINT source. A key limitation of this system is its large footprint.

**Fusion, Reconnaissance and Combat Reporting**

A final intelligence collection means to be considered is reconnaissance and combat reporting activity. In the typical scenario, reconnaissance reports are received by the SARC representative via voice/data radio, or face-to-face debriefings. These reports typically conform to the Size, Activity, Location, Unit, Time, and Equipment (SALUTE)

[35] MCWP 2-1, 3-9.

format for spot reporting. It is the SARC that functions as the single-source processing and validation center. The SARC evaluates, filters, and confirms reported information prior to presentation to the IOC.

To accommodate this requirement, a distributed architecture would be most efficient. Battalion level units must have the capability of feeding the intelligence picture from their vantage point. Likewise, there must be automated entry of SALUTE-type reports from pilot debriefings, reports from adjacent units, or supporting Special Operations units. The SARC must apply single-source validation to this information, just as the TEG, TCAC, or TRSS does for their respective disciplines. Once cleared by this initial processing facility, however, introduction into the all-source intelligence picture must be automatic and free of duplicative or labor-intensive manual processing.

**Fusion Systems and Connectivity**

The Intelligence Analysis System (IAS) was developed to be the core system for all-source intelligence fusion in the Marine Corps. The IAS automates intelligence activities throughout the intelligence cycle, and follows a long string of precursor programs that sought to achieve much the same purpose. Although the IAS has been fielded, it does not change the underlying doctrine or hierarchical processes that drive intelligence activities. The system successfully gets some required intelligence analyst support *tools* to the battlefield, and provides a basis for data connectivity with other C4I systems on the battlefield. The system provides most of the capabilities of a JDISS terminal, and provides connectivity to theater and national intelligence resources. A number of systems that nominally have direct or indirect connectivity to the IAS are shown in Figure 6.

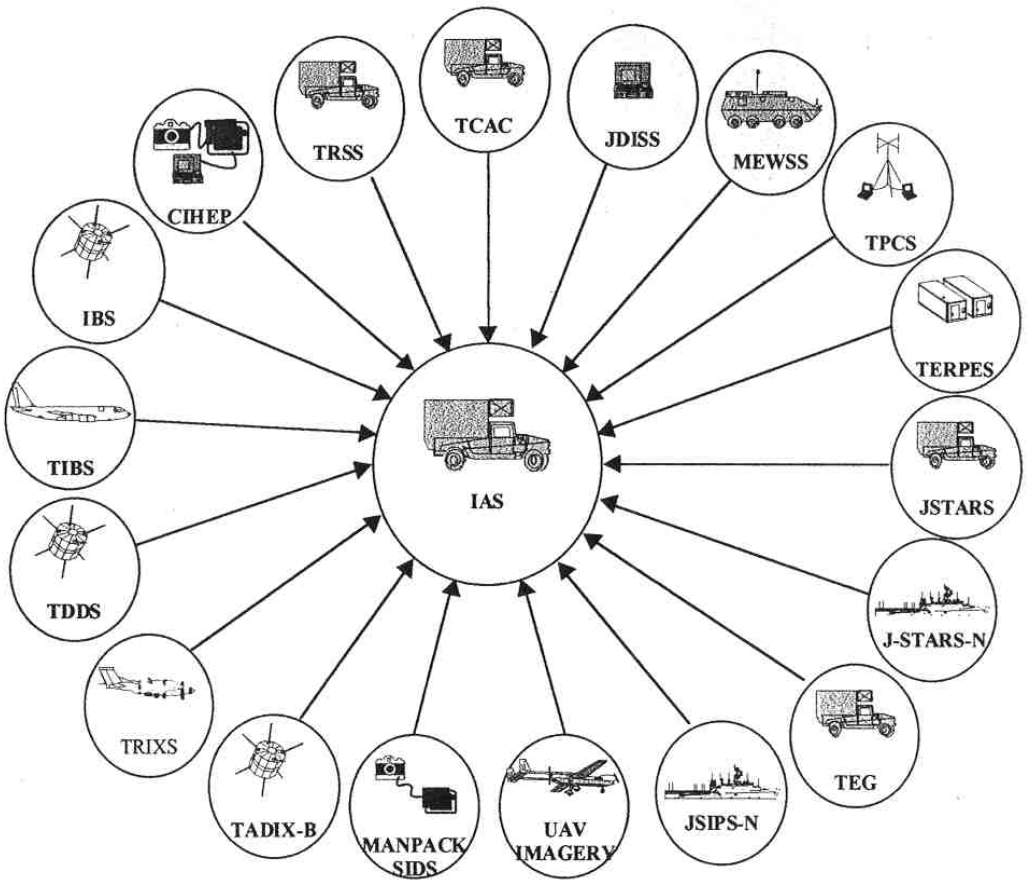


**Figure 6. IAS Connectivity Systems**[36]

Yet, some significant criticisms of the IAS have been made:

> [IAS] is still not an intelligence analysis system, as the name suggests, and it is *not* going to fix the most critical problem-fusing intelligence data from various sources. IAS simply does not do the job that it was intended to do - receive information from various collection sources and fuse that information into intelligence. In actuality it fuses nothing. Receiving messages from different sources is *not* fusion.[37]

This seemingly harsh criticism strikes to the heart of the matter. The IAS is an enabler that eases the analyst's workload, yet it is not an all-source *fusion* system.

[36] NTISA, 3-2. Some of these systems also have indirect connectivity through TCAC or TEG.

Although intelligence fusion is primarily a *human* activity, the systems architecture that supports it must relieve the human of much of the burden of manually inputting reports, correlating quantified elements of information, archiving, and processing large volumes of data. This frees the human analyst to deconflict information, apply expertise, and derive estimative intelligence. IAS is missing the capability to automatically process received reports in a manner that provides correlation of data elements, elimination of reporting redundancy, cross-referencing between intelligence disciplines, trend-analysis, or time-phasing. IAS operators must still review received messages one at a time, manually input them into the IAS, and assemble information elements to workbooks and folders without automated assistance. This methodology is exceedingly inefficient and prone to errors.

**Chapter Summary**

The current Marine Corps approach to intelligence fusion is manually intensive and segregated by individual discipline. Each discipline has its own unique single-source system that provides processing and some level of analysis. Some of these single-source systems are able to feed the overall intelligence picture by means of automated reports and formats. Unfortunately, most of these cannot be automatically processed, archived, or correlated by the IAS fusion hub of the MAGTF. Although the IAS provides some software tools to support analysts, it still remains a manually intensive support tool that fails to really conduct some basic fusion processing.

[37] Farmer, 35.

# CHAPTER 5

# SYSTEMIC RECOMMENDATIONS

The previous chapter identified several weaknesses of the existing Marine Corps intelligence fusion architecture. This chapter and the next contain a number of recommendations that would improve the ability of the Marine Corps to equip itself with a systems architecture that is designed for fusion. The focus of this chapter is a set of *systemic* changes that could focus our efforts on the development of a fusion-friendly architecture. These changes reflect the importance of centralized resource coordination as learned from the national intelligence community, and the importance of unity of effort in the systems development process as practiced by the Army. The next chapter contains a set of technical and programmatic proposals that could serve as a baseline for a fusion-friendly technical and programmatic architecture. In a sense, the recommended changes of this chapter form the operational campaign that links the tactical proposals of the next chapter to the strategic end-state of a fielded fusion architecture. The systemic changes required to accomplish the intelligence fusion effort begin with the establishment of a "roadmap."

## The Roadmap

The roadmap is simply an easily understandable description of the desired end-state and intended route for intelligence systems migration. It is important as an intelligence

fusion issue, as it changes the focus on individual information generating systems to a focus on the fused product of the entire architecture. It ensures that the Marine Corps focus is on *knowledge* rather than *information*. Central to making this happen is countering an information superiority mantra that fails to recognize the requirement for fusion to the same degree as high technology collection and dissemination.

The roadmap must be, quite literally, a graphic chart that could hang on the wall of intelligence functional advocates, and every member of the intelligence combat development process. Although sponsored and issued "down" from the top, the development of the intelligence system roadmap must be a coordinated effort between system user representatives, system developers, doctrine writers, and program resource sponsors. The roadmap would identify the desired end-states for Marine Corps intelligence systems development for the next two-year budget cycle, the next six year Future Year Defense Program (FYDP), and objectives beyond that. It would prioritize acquisition programs across the intelligence disciplines, and identify fusion and processing links that must be developed to keep pace with the development of collection systems. The objective roadmap would be flexible enough to accommodate shifts in missions, technology, or operational concepts, but would be directive and detailed enough to provide positive leadership on technical issues. With this type of vision establishing the *commander's intent* of the intelligence functional leadership, the Marines serving in the elements of *resource sponsorship, doctrine development, and concept generation* can serve their own organizational masters while still working toward a common purpose.

Perhaps most importantly, the roadmap would serve as a *filter* for good ideas. Too many uncoordinated good ideas executing simultaneously have a tendency to reduce the overall tempo of the systems development process, much akin to the problem of information overload. Under the roadmap vision, no new systems would be pursued, developed, or even accepted without an identified and supported position in the overall architecture. To implement the roadmap, however, strong functional sponsorship must be in place to develop, consolidate, and enforce the vision. This cannot be accomplished under the broad net that captures intelligence along with the four "C's of C4I (or the even more monstrous C4ISR.)

**Taking the "I" out of "C4I"**

Beginning at the service level, the Marine Corps must break out the "I" from "C4I." The Commandant has recently announced his intent to do so, and it is a tremendously positive step toward "operationalizing" intelligence.[38] As discussed in chapter three, the army has already unified their functional sponsorship for intelligence separate from their "C4" systems.

Although intelligence processing is handled by much of the same technology as other data handling functions, the combining of intelligence with information systems has been detrimental to the roots of the *function* of intelligence. To manage all this "computer stuff" these various elements were consolidated by technology (instead of function) and relegated to the technologists. What was lost in this transformation was the focus on the purpose the various technologies were to serve in the first place. Like the roadmap, a return to independent functional sponsorship of intelligence provides a

[38] Ennis, 46.

renewed focus on the output of a fused architecture rather than on simple information generation. Now that fear of technology has begun to fade, Marine Corps intelligence is presented the opportunity to return to its *functional* roots.

**Establishment of an Intelligence Proponancy Board**

The effective separation of "I" from "C4" must be supported by the establishment of a formal board for intelligence proponancy within the Corps. As in the national establishment, splintering of functional proponancy for collection and analysis along the lines of intelligence disciplines is detrimental to fusion. In his initial guidance, Commandant Jones called for proponancy boards for the Ground Combat Element (GCE), Aviation Combat Element (ACE), and the Command Element (CE). This same model should be applied to the intelligence field.

The tasks of occupational field sponsorship, representation of the intelligence community in resource battles, development of training pipelines, and maintenance of career progression models must continue to be met as they are today. Beyond meeting the demands for intelligence today, however, there must be a formalized structure for planning and directing intelligence of the future. Though it may seem far removed, the intelligence proponancy board is a critical proactive step forward to achieving intelligence fusion on future battlefields.

This proponancy board would provide the desperately required intelligence roadmap, and would serve as the "keeper of the flame" for the intelligence community. It would provide a shared vision, from detailed budgetary guidance for the next POM cycle to the ten-year vision of where Marine Corps intelligence is headed.

> Intelligence proponancy is very diffuse. Acquisition programs, financial resources, people, total force structure…they all belong to different (non-

> intel) bosses…each with their own stovepipe concerns. Intelligence proponancy is spread thin across too many players. If the combat development process cannot even list their priorities for intelligence, how can we even begin to solve them? [39]

The core of this proponancy board would be a permanently staffed agency of HQMC. The preponderance of the membership, however, would be a chartered gathering of intelligence community representatives convening on a regular basis to define, prioritize, and draft the roadmap for intelligence development. This convocation of the "gray beards" of the intelligence community would be empowered to set the agenda for intelligence doctrinal and systems development.

**Training for Intelligence Fusion**

An unfortunate aspect of much of our operational intelligence training is a reliance on short-duration, highly scripted exercises. These exercises make it hard to judge the effectiveness of intelligence organization, and give little opportunity to practice *fusion*. Other MAGTF priorities drive these scripted scenarios, not the education of intelligence operators and analysts. "Training the way we fight" is a mantra that echoes from the lowest to the highest levels of the Corps. "We must train the way we fight" is an established priority for our new commandant.[40] To make this happen, however, the intelligence community must begin to train for distributed operations and multi-disciplinary fusion as part of a large-scale intelligence-centered exercise. The intelligence architecture must also validate support concepts for all levels of MAGTF employment. "We only ever get to practice "real" intelligence with the MEU, or

[39] Maj Emile Sander, USMC, Doctrine Division, Marine Corps Combat Development Command, interview conducted by author, 14 December 1999.
[40] Commandant Gen James Jones, USMC, *Commandant's Guidance*, July 1999.

Battalion sized exercises. At the MEF, you're spending your time fighting fires."[41] The Intelligence battalion is the logical sponsor of this effort. These exercises should take place for the purposes of ironing out the weaknesses in intelligence fusion architecture, testing and evaluating new fusion techniques, and validating fusion support concepts.

**Unity of Effort in the Systems Development Process**

The Planning, Programming, Budgeting System (PPBS) is a 1960's construction that could deal adequately with development of stove-pipe systems. It is inadequate, however, to support integrated systems development. Trying to accomplish fast moving, high-technology development within this aging and increasingly inadequate PPBS system is not easy. The DOD mandates the same approach to systems development for an advanced intelligence data fusion correlation and visualization system as it does for the procurement of a thousand sets of thermal underwear.

The Marine Corps intelligence community must put discipline in the acquisition process by providing unity of effort in the execution of our intelligence programs. A system or program that does not fit in the approved architecture must not be allowed to divert resources and management attention away from those that do. The desired intelligence systems development roadmap must not seek to *accommodate* on-going efforts. Instead, it must eliminate intelligence programs that do not fit the desired end-state of the Marine Corps intelligence systems architecture.

Given the focus of limited resources on individual collection systems, there is little maneuver space remaining for fusion requirements. Our systems development processes are established on a model of replacing existing systems with similar systems that

[41] Maj Chandler Hirsch, USMC, Intelligence Requirements Branch, Marine Corps Combat Development

accomplish the same function, but with the latest technology applied. For example, the Marine Corps processes result in a lot of attention and money spent on replacing old SIGINT systems with new SIGINT systems, but little attention and money integrating SIGINT systems with IMINT systems. There is little attention given to *fusion* by the specialists of each independent intelligence discipline, nor is there much incentive to provide this attention. Given the choice between resourcing more collection capability within a given intelligence discipline or making that same discipline more fusion-friendly, discipline advocates will often choose the former. Without strong unity of effort that includes a focus on fused products, programmatic momentum will dictate system development priorities by default.

A unity of effort in resource management tied to the intelligence roadmap would correct this imbalance. This would be manifested in two ways. The first is a clear delineation of program priority in resource allocations within the PPBS process. Programs that contribute to the fusion architecture would take precedence for resources over stovepipe systems. Second, Operational Requirements Documents (ORD's) would be drafted so as to restore some flexibility to the system designers. This would be accomplished by consolidating ORD documentation along *functional fusion architecture outputs* rather than individual system technical parameters.

**Operational Requirement Document (ORD) Consolidation**

One change already under consideration is the consolidation of Operational Requirements Documents for the multiple intelligence analysis programs being concurrently developed/upgraded by the Marine Corps. For fusion, this implies that the

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Command, interview by author, 3 December 1999.

systems in question would be held to the standard of fused output from the architecture as a whole, rather than the segmented output of individual contributors to the overall intelligence picture. In the near term, the new ORD would consolidate requirements documentation for the IAS, TCAC, and TERPES systems.[42] In the future, the system could grow to encompass the capabilities of the JSTARS CGS, TEG, or even a UAV control station.

Much like the Army's TES system, a new family of Marine Corps intelligence systems would provide modular, scaleable capability based on Marine Corps Common Hardware Suite (MCHS) components. The new intelligence fusion system ORD will specify hardware, software, and connectivity elements to enable the system to take thousands of automated informational "hits," correlate them, deconflict them, and provide an updated all-source picture to a fusion cell.

**Program Manager for Intelligence**

A second difficulty in providing interoperable intelligence fusion systems is the separation of intelligence programs across multiple Program Managers within the Marine Corps Systems Command. Currently, intelligence programs are split between the PM-Intelligence and Communications systems (PMIC), and the PM-Information Systems (PMIS). Within these PMs there are further subdivisions of programs within Assistant Program Managers (APMs) for various intelligence disciplines. Within the APM, individual projects are often overwhelmed by the challenges of resourcing, contracting, directing, and executing simultaneously, so that interoperability issues, common technical standards, and the desirability of a common fusion environment are given low priority.

[42] Hirsch interview, 3 December 1999.

Ironically, as programs compete against each other for scarce resources, project officers are disincentivized from working together across organizational boundaries to achieve larger "system" goals.

One of the primary means for alleviating these organizational impediments would be the consolidation of all intelligence programs under a single intelligence colonel serving as the Program Manager for Intelligence. This is similar to the Army's PM Fusion concept, but also includes coordination responsibilities for collection systems as well as production and analysis systems. The smaller scale of Marine Corps intelligence programs makes this possible.

Going a step further, instead of organizing by individual projects, the PM Intelligence office should be organized into functional teams. Team leaders should be responsible for the *warfighting functionality* of a group of programs. This replaces the model of individual project officers competing with each other for resources instead of focusing on technical compatibility among systems. For example, one individual within a team could be charged with financial resource management for several programs, leaving the other team members unburdened to coordinate technical development among them. Technical and operational testing would encompass multiple systems working together, rather than the current paradigm that tests programs one at a time. Intelligence fusion and effective *combined* performance would become the larger goal of the organization, rather than individual system performance.

**Equipping for Fusion Through Sponsored Research and Development**

A final systemic recommendation is to change the uncoordinated fashion that research and development is conducted for intelligence. Most of the current research and

development efforts are focused on increasing the technical effectiveness of a given program, rather than working to increase the effectiveness of integration among programs. Some of the overlooked resources include directed research projects at the Naval Postgraduate School (NPS), as well as sponsorship of research efforts at the Office of Naval Research, Navy Research Laboratory, or even the Marine Corps Warfighting Lab. The consolidation and team management of intelligence programs under a single PM could facilitate a focus of research and development on overall architecture warfighting performance, and maximize the Marine Corps' return on investment.

**Chapter Summary**

Equipping the Marine Corps with a responsive intelligence fusion architecture requires more than simple equipment changes. A host of *systemic* changes are required to set the stage for the introduction of a new architecture that is designed for fusion. Achieving *knowledge dominance* through intelligence fusion instead of *information superiority* depends on enacting a number of principles to overcome the identified weaknesses of our current processes. Among the changes required are the development of an intelligence roadmap to gain unity of effort, the return to the functional roots of intelligence by taking the "I" out of "C4I", and the establishment of an intelligence proponancy board. These actions would enable dramatic changes to our intelligence combat development process, replacing a focus on individual intelligence systems with a concentration on the fused output of the entire intelligence architecture.

# CHAPTER 6

# A PROPOSED ARCHITECTURE FOR FUSION

The previous chapter identified a set of systemic changes that would create an *environment* for implementation of a fusion-friendly technical architecture. This chapter proposes such an architecture based on a decentralized collaborative network. These recommendations reflect the lessons discussed in chapter three from the national, joint, and private sector environments. The network concept, the operational role of the intelligence battalion, and a recommended migration route for intelligence system acquisition programs are all included in the proposal. Finally, a few recommendations are made for future developments once the core network capability has been established.

## Distributing the Fusion Environment

One of the dangers of the current intelligence fusion environment is a misplaced confidence in information systems, "smart" technology, and the ability of a centralized intelligence bureaucracy to drive operations on the battlefield. The corresponding fixation on large-scale, expensive collection systems is easily explained, "Satellites are sexy…fusion engines and data correlators are not!"[43] To the established functional bureaucracies, these collection systems become ends in themselves.

[43] Hirsch interview, 3 December 1999.

If Clausewitz is right, the "clash of irreconcilable wills" demands a different focus. Where we currently seek to eliminate uncertainty by practicing individual disciplines with ever more precision, we need to focus on providing a fused product with an expectation of a certain degree of uncertainty. Since Marine Corps operations will retain a focus on the enemy, our intelligence architecture must be responsive to tactical commanders at all levels.

The current model for Marine Corps intelligence fusion places the bulk of intelligence resources and systems at or near the MEF headquarters, with the intelligence fusion effort primarily responsive to the priorities of the MEF commander. A single fused intelligence picture prepared for the MEF commander, however, may not be responsive enough to lower echelon commanders. Lower echelon commanders have little flexibility to tailor the products of the top-down centralized intelligence system to their individual tactical circumstances. With their focus on operational level issues, the intelligence experts clustered at the MEF may know less about what the enemy is doing than the tactical units they are trying to support. To the supported tactical commander, intelligence appears "broken."

**A Collaborative Distributed Fusion Network**

The dual requirement to support MEF level intelligence operations and to provide products tailored to the unique demands of multiple tactical units suggests that the intelligence fusion effort be distributed among a cooperative network of users and producers. A distributed Marine Corps fusion capability would restore responsiveness to tactical intelligence users, and would serve to counter supported commander's fears that a centralized intelligence bureaucracy may not be focused on their unique demands.

One potential solution is a network of decentralized operators and analysts *collaborating* on the larger intelligence picture. In this distributed networked environment, a primary "node" located at the MEF provides a baseline intelligence product, which is tailored and updated by tactical unit "nodes" distributed across the battlefield. Unlike a conventional “top-down” approach, the intelligence products disseminated by the primary node are not the *end* of the intelligence cycle. Instead, they are the *beginning* of a collaboration among nodes to achieve a better battlefield picture. The primary node continues to provide intelligence support to the MEF commander, and serves as the sponsor for maintenance and support of the distributed network. Each client node possesses a self-contained capability for independent intelligence operations, while retaining the linkage to functional expertise and the larger fusion environment via the network. By allowing distributed maneuver elements to "act locally" while "thinking globally," the Marine Corps takes advantage of both the responsiveness a distributed network provides and the analysis *mass* provided by the primary node.

*Collaboration* implies that the network allows tactical nodes to work with MEF intelligence nodes, external agencies, or adjacent units in real time and without unduly restrictive bureaucratic control. Collaboration is conducted via an on-line “bulletin-board” or “chat” system. Distributed nodes can access the databases and intelligence feeds held by the primary node, can relay information requests to external resources, and can delve into a greater depth on items of tactical interest.

Organic intelligence collections and external intelligence feeds are still routed to a primary node on the network, which is equipped with automated fusion tools and most of the analytical resources the MEF has available. The primary node is much like the

current MAFC in concept, and remains responsive to the requirements of the MEF commander. In addition, the primary node provides a set of core fused intelligence products to the network, and acts as the fusion *sponsor* rather than the owner of the entire process. This primary node provides the linkage to intelligence resources outside of the MEF, and conducts operational-level analysis. The limited number of intelligence resources, area experts, and analysts drives the requirement for a primary node. These assets provide the *mass* required to create the basic fused intelligence products which underlie the collaborative picture. In the long term, the requirement for a primary node may be diminished if much of the intelligence fusion process could be automated. It is unlikely, however, that this fundamentally *human* task of fusing intelligence products can ever be entirely replaced by a machine.

Distributed nodes are maintained by supported tactical units of battalion or larger size. These tactical nodes, equipped with a robust set of tools and *some* level of analytical capability, access and tailor this baseline intelligence estimate to their own desires. This tailorability is crucial, as it allows dispersed tactical units to fuse information that is critical to their local mission. Tactical nodes also use the network to update and refine the baseline intelligence products of the primary node. A distributed capability accommodates this *information flow reversal*, where tactical intelligence users become "bottom-up" intelligence producers. This architecture also eases intelligence coordination burdens between adjacent units by allowing direct connectivity and interaction.

With emerging doctrines such as OMFTS, Marines can expect to operate at long ranges from centralized command and control positions. Likewise, highly mobile

maneuver elements must be capable of operating without a major lodgment ashore. This implies that some of the nodes of the intelligence network may be located on ships at sea or even out of theater entirely. Distributed nodes of the network would be able to access the core products from wherever the primary node was located, tailor them to their own tactical requirements, and collaborate with the primary server on updates and intelligence shortfalls. Thus, while the primary node provides the information resources and a default battlefield picture, the distributed client is responsible for expanding the range and depth of his own fused tactical picture by using the tools provided by the primary node.

The organic MEF intelligence collection systems that would feed this network would migrate toward a common set of software and hardware tools that could eventually combine separate functional disciplines into single multi-function platforms. A series of modularized single-source elements would feed a centralized all-source fusion system at the primary node, and this fused product would be distributed throughout the battlespace via the distributed network.

Figure 7 illustrates the proposed network architecture. In this objective architecture, each node contributes to the overall intelligence picture. It pushes responsibility for fusion and collaboration outward to forward engaged units, yet allows the entire network to collaborate on responding to the units that most need the assistance.

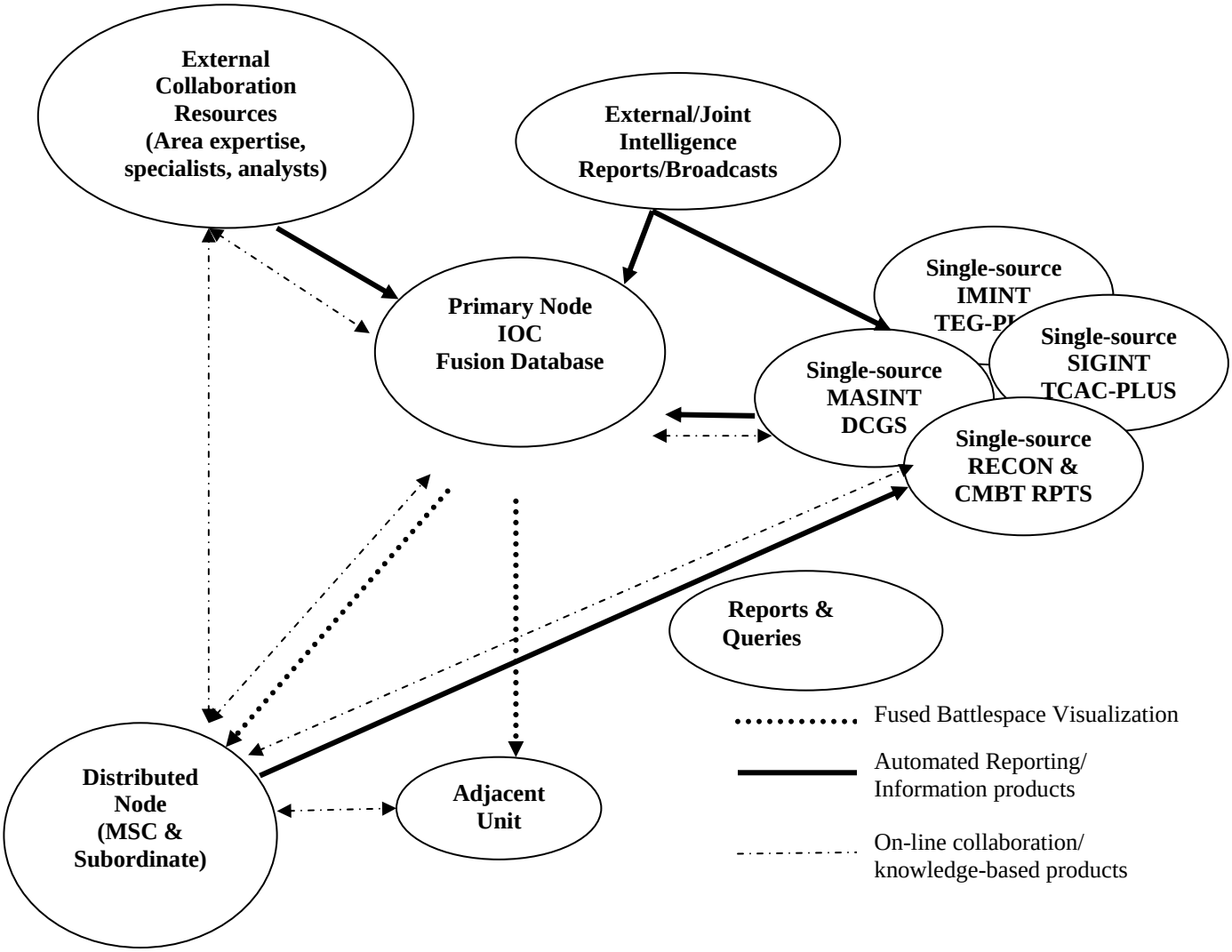


**Figure 7. A Proposed Distributed Fusion Network**

When confronted with new information, a forward node can reach-back to the network of experts collaborating on the overall fused intelligence product. This is much like the concept espoused by the consulting firms discussed in chapter three. This collaboration could even include experts outside the MAGTF, or sea-based supporting units. In some scenarios, an external agency resource, an economist, social scientist, or

local diplomat may be added as a node on the network. The expertise represented by the geographically-dispersed team responds quickly to the needs of a distributed node, just as the individual nodes contribute to the overall picture through their own combat reporting. The decentralized nature of the intelligence network is its strength. It is not driven down or driven up, it is horizontally integrated.

> Decentralization allows for proactive inquiry into the battlespace, a key element to effective intelligence support to maneuver warfare. Other advantages include the ability to make mid-course changes and rapidly generate tailored intelligence. Perhaps most importantly, decentralization allows for a shift from rote-based information processing to intellect-centric work.[44]

**The Intelligence Battalion as the Primary Node**

Even with a distributed collaborative network, there must be a battlefield sponsor for coordinating, training, and maintaining the effort. The "operationalizing" of the intelligence battalion within each MEF provides the sound basis for this to occur. The intelligence battalion must become the primary node for the collection, processing, and production of core fused intelligence products from organic as well as external sources, and from a variety of disciplines. The intelligence battalion is decidedly *not* an administrative headquarters providing detachments as necessary to support independent MAGTF's. Instead, the intelligence battalion focuses on *intelligence operations*.

Responsibility for the *local* fused intelligence picture must be distributed to tactical commanders, but the intelligence battalion must be an effective producer of the tools that support this distributed fusion to *all* elements of the MEF. The warfighting principle of *mass* applies to the intelligence effort as well as to tactical operations. Miniature intelligence cells parsed throughout the MEF will not have the comprehensive expertise

[44] Cukor, 205.

required to fuse all of the information available from the many sources of information. There must be some fusion that occurs above the tactical level in order protect tactical users from information overload. Manpower and fiscal constraints, technical requirements, and specialized training dictate that the intelligence battalion must be this initial fusion center, and the global source of MEF intelligence resources. This "operationalized" intelligence structure must be organized for fusion, processing, and analysis. It must be ready to support sea-based operations, and must even be prepared to support widely disbursed maneuver elements from a CONUS base.

**Migration of Equipment and Programs**

The objective material solution for the proposed intelligence fusion network must take maximum advantage of existing Marine Corps and other service programs. By building this new generation of intelligence fusion products under the cognizance of a single program manger, technical hardware baseline commonality can be assured, interoperability would be focused, and priorities made clear. The material solution to support a distributed network requires an automated fusion system at the primary node, updated collection systems that operate on a set of common software and hardware modules, and distributed intelligence nodes that have the tools to operate independently.

Equipping the primary node with an automated fusion correlation system, or "fusion engine," must be the first priority in building this intelligence fusion network. Intelligence fusion is a *human* activity, but there are large subsets of this process that can be automated. Intelligence analysts should be relieved of the burden of manual data entry, manual trend analysis, correlation of quantifiable data elements, and manual report deconfliction. Instead of forcing our senior intelligence analysts to work *for* the machine,

the fusion engine must provide the tools to allow the human to spend his intellectual resources on fusion and estimative intelligence derivation.

The existing IAS system provides a valuable connectivity backbone, and an adequate *host* for a fusion system, even if it does not yet meet the fundamental fusion requirement. The tools contained in the IAS have a defined upgrade path, multi-service commonality, and comply with the interoperability standard MAGTF Software Baseline (MSBL). Building on the solid foundation provided by these core capabilities, the IAS could be turned into a *real* fusion system by development of a "fusion engine."

The fusion engine within the IAS must host the database correlation processing between databases held by the single-source sponsors for IMINT, SIGINT, HUMINT, and MASINT. An example of a fusion engine called the Automated Real-Time Data Fusion (ARTDF) correlator is currently under development for the Marine Corps' TERPES program. Development of an ARTDF correlator within the IAS system would provide an automated fusion capability that serves as a primary building block of the total MAGTF fusion effort. This system automates much of the correlation of data elements currently conducted manually by the analyst or operator.

Automated correlation templates can be used to filter duplicative information, match measured information to national databases, and link threat equipment detected to capabilities and order of battle information. For example, the detection of a specified transmitter could automatically cue a link to the unit-type of that equipment, associated threat systems, and a graphic portrayal of weapons-effects ranges; all without the operator having to manually conduct each step. The automation of much of this process

frees the intelligence analyst from database correlation activity, and allows him to focus on *estimative* intelligence derivation.

The second priority must be to establish intermediate connectivity between legacy collection systems and the IAS fusion engine. Each of the single source collection systems must have an automated reporting mechanism that provides for the transfer of large volumes of information to the fusion database. The current model is designed to accommodate single 'hits' reported from a single source collection system to the IOC. For example, a single SIGINT collection of a radio transmission may be the subject of an individual report. This represents a significant bottleneck, as many of our collection systems now have the capability to automatically collect thousands of radio transmissions simultaneously. By building the architecture and data connectivity to accommodate transmission of *databases* rather than *individual reports*, the amount of data available to be fused into the intelligence picture is greatly increased.

Extending the reach of the distributed nodes of the network is a third priority. These distributed nodes should be built with a wide range of connectivity options. The environment to which the network is to be subjected implies that continuous connectivity cannot be assumed. The network must be built to withstand (even expect) repeated disruptions in connectivity, and must quickly evaluate where a node is, and when it was last updated. When an update is required, the system will capitalize on a number of battlefield connectivity options, and quickly update a locally stored profile. Between connectivity "blackouts," the using unit at least has a picture of the battlespace just before connectivity was lost. By using standard browser-type interfaces, training requirements will be minimized. If the system interface looks and feels like a structured “bulletin

board" or "chat room," then most users will have an intuitive familiarity with the interfaces, and operations.

The effects of the proliferation of devices, connectivity, and software packages from a host of DOD/government agencies are problematic to the end-users, who must find a way to fuse the products of these individual systems. Each well-intentioned package brings another connectivity headache, training issues, larger footprint, and fusion difficulties along with its advertised capability. A fourth priority for development, then, is a baseline for a modularized family of systems, each with common hardware, which would act as single-source intelligence processors. The members of the family could include a TEG-PLUS capability for IMINT, a TCAC-PLUS capability for SIGINT, a MASINT-PLUS capability for MASINT, and a SARC-PLUS capability for combat reporting. These systems, based on a common vehicle/shelter family, would differ only in software loads and special external connectivity requirements. As technology advances and capabilities are modularized, multiple single-source processing might be able to occur on a single platform. Sharing a common hardware baseline, a common "look and feel" man-machine interface, and similar database structures would greatly ease the problems of integrating each new system into an overall architecture.

One segment of this common collection system baseline would be the integration of all imagery products into a new "TEG-PLUS" system.[45] The new TEG-PLUS would comply with the ASD-C3I mandate for a Distributed Common Ground Station (DCGS) architecture for imagery product management, broadcast reception, and control of Unmanned Aerial Vehicles (UAV's). Thus, TEG-PLUS family of systems could be

[45] Capt Larry Richards, USMC, Imagery Intelligence Systems Project Officer at Marine Corps Systems Command, interview by author, 29 September 1999.

modularized to include not only image processing, but also UAV RRU capability. The Tactical Control System (TCS) found in the Canadian Defence Forces goes even a step further by providing UAV control capability on the same platform.[46] The TEG-PLUS would also receive and process still imagery products from SIDS and other digital imagery sources. The TEG-PLUS would serve as "imagery central" for the IOC, and provide single-source imagery intelligence fusion collaboration for the all-source fusion effort. The TEG-PLUS operators would integrate imagery collection into both planning and execution, thereby enabling the ISC to manage this element within the MEF intelligence architecture.

The single source sponsor for SIGINT could also migrate to an improved version of the TCAC. The OCAC would benefit greatly from an evolution to a "TCAC-PLUS" system as the SIGINT counterpart to the IMINT TEG-PLUS. This would reduce the number of pathways for SIGINT information, and could become the process owner for SIGINT operations. Ideally, this TCAC-PLUS would integrate an ARTDF correlator, and be able to conduct TERPES processing (perhaps as a modular capability.) TCAC-PLUS would be the ISC's means of integrating and controlling the SIGINT effort. By using the same hardware and software tools as the TEG-PLUS, some necking down of collection stovepipes could begin.

There is currently no single-source fusion point for MASINT like there is for SIGINT or IMINT. Each of the individual MASINT systems collects and reports its particular stovepipe to the SARC, usually manually or over single channel voice radio. It would also be possible to use identical computer hardware and a modularized software

[46] Maj Ian Glenn, Canadian Army, Intelligence Requirements Officer, Canadian National Defence Forces, interview by author, 17 August 1999.

architecture in a "MASINT-PLUS" version of the TEG-PLUS. MASINT reports are tailor-made for fusion. They are typically quantifiable by nature, and can be easily correlated with SIGINT, IMINT, or other indicators. MASINT systems currently in development, such as the UAV-mounted Coastal Battlefield Reconnaissance Aircraft (COBRA) minefield detection capability could be integrated into a single-source MASINT-PLUS fusion and control system. MASINT single-source fusion and analysis could be accomplished via a separate MASINT-PLUS vehicle, or possibly a software module on a TEG-PLUS already deployed in-theater. It may even be possible to monitor remote sensors via a Low-Earth Orbit (LEO) satellite service with a sea-based or CONUS-based MASINT single-source fusion cell. This would provide MASINT single-source intelligence to the IOC or the supporting all-source intelligence fusion center, without the footprint associated with an additional ground station.

**Long-term Possibilities in Geographic Intelligence**

Once some unity of effort in resource management is attained, some technical interoperability is achieved, and the collaborative fusion capability is established, the Marine Corps can begin to take full advantage of promising technologies in a coordinated fashion. The consolidation of imagery and topographic products is one promising fusion enabler. Currently, topographic products are provided by the Topographic Production Capability (TPC) system within the Topographic Platoon. Sometimes referred to as Geographic Intelligence (GEOINT), this capability is an important element of battlefield visualization. The current capability to send and receive digital map products, provide plotters and printers for maps, and provide topographic map overlays may soon be replaced by an integrated system that provides graphic, three-dimensional simulations of

the battlefield. Near-term plans for digitally terrain-mapping large swaths of the Earth's surface via a space shuttle radar topography mission which will enable scene visualization for mission planning and "will do in an 11-day mission what has taken [NIMA] over 20 years to collect."[47] Current NIMA deployable systems include a small computer server loaded with *layered* geospatial and imagery products at a variety of scales. The system allows for zooming between map and image scales without the necessity of shuffling piles of CD-ROM's or manually opening and closing files.[48] Harnessing the power of integrated imagery and topographic data must become a central goal of the fusion architecture, and could be included in a TEG-PLUS as a modular addition.

**Long-term Possibilities in Visualization Technology**

It is in the computer-aided visualization of the battlespace that all-source intelligence fusion becomes most realistic and powerful. Commanders could conduct mission planning, mission rehearsals, even mission briefings in a distributed fashion. Subordinate commanders could be assigned tasks and given a detailed picture of commander's intent without having to leave their own units. The intelligence fusion effort must better "visualize" the battlespace for the commander so he can focus his attention on reacting to it. This is a critical component of the *utilization* of a fused intelligence product. Providing the commander with a "virtual sand table" that contains topography, hydrography, trafficability, and the expected weather picture would be valuable in itself.

[47] LTG James King, USA, NIMA Director, quoted in "Balkans Serve as Proving Ground for Operational Imagery Support," *Signal*, October 1999, 18.
[48] Robert Ackerman, "Balkans Serve as Proving Ground for Operational Imagery Support," *Signal*, October 1999, 19.

Automatically layering-in threat intelligence with a common symbology and graphic weapons effects rings increases the commander's battlespace awareness exponentially.

**Long-term Possibilities in Emerging Technology**

Some of the most promising emerging technology leverages are in the computer modeling, simulation, and gaming fields. Three-dimensional models of expansive battlespaces are not only possible, but also have been used extensively in everything from on-line fantasy role-playing games to flight simulators. The Marine Corps must look to these areas in line with a focused intelligence system development roadmap. These various emerging technologies could be key enablers to intelligence fusion and battlefield visualization efforts.

The computer screen will gradually replace the hard-copy map as an accepted method for geographic visualization. Marine Corps officers at the Naval Postgraduate School have conducted extensive work in the modeling and simulation (M&S) field for several years.[49] Much of the research has been focused on heads-up displays, wearable computers, and other information dissemination and display technologies, all of which could support the dissemination and utilization of fused intelligence products. As a first step, establishing data connectivity and information visualization models is encouraging.

Ongoing efforts at the Defense Advanced Research Projects Agency (DARPA) are working to efficiently analyze imagery data and apply automated filtering techniques to reduce the amount of "information" pumped to battlefield commanders, and focus the

[49] The Naval Postgraduate School hosts an extensive M&S laboratory in which student Master's thesis projects are tested, developed, and integrated. Most of the research is conducted by officer students.

commanders attention on only those elements that are indications of significant activity. Automated fusion correlators could fuse disparate intelligence inputs, provide recurring background battlespace monitoring, and deconflict collected information without the necessity of a human analyst in the loop. These smart data processing and filtering techniques will allow the human decision-maker to focus on reacting to the environment rather than discerning it. The development of "expert systems" that mirror human decision processes, and "intelligent agents" that conduct data mining and search functions without human intervention are two examples. Automated decision aids that recognize, assimilate, and correlate received information are beginning to appear throughout the business community.

Using high bandwidth dissemination networks, data compression techniques, and the like, this knowledge could be forwarded to distributed client nodes on a battlefield knowledge grid, much like as discussed above. In MOUT, for example, imagery data could be synthesized with electrical grid diagrams, water and sewer line topography, and annotated street maps to provide a small unit commander with complete situational awareness of the neighborhood he has been ordered to clear

**Summary and Conclusions**

The simultaneous arrival of a crisis in credibility for the intelligence community, incredible advances in technology, and the evolution of new operational concepts like OMFTS poses an incredible challenge for intelligence professionals. This environment mandates a fresh look at our ability to conduct cross-discipline intelligence fusion across the spectrum of conflict.

Central to the issue is recognizing intelligence fusion as an *information management* problem rather than an *information technology* problem. Achieving *knowledge dominance* through intelligence fusion, instead of *information superiority* through more data, will require a number of changes to overcome the identified weaknesses of our current processes. The Marine Corps can make adjustments to both the systems development process and intelligence functional sponsorship to better fuse the products of "stovepipe" intelligence disciplines into a coherent and complete intelligence estimate.

The Marine Corps can make a number of changes in the systems development environment that leverage the lessons of intelligence fusion at the national level, the joint community, and in private industry. These sources indicate that unity of effort in functional sponsorship, disciplined resource allocation, and coordinated systems development makes the intelligence architecture more responsive. Unity of effort replaces a natural tendency toward focusing on intelligence *systems* with a focus on fused intelligence *products*. Among the environmental changes required are the development of an intelligence roadmap to gain unity of effort, the return to the functional roots of intelligence by taking the "I" out of "C4I", and the establishment of an intelligence proponancy board.

Equipping the Marine Corps for intelligence fusion also requires a new systems architecture that is designed for distributed fusion, and responsive to intelligence users at all levels. The current Marine Corps approach to intelligence fusion is manually intensive, rigidly controlled from the top, and segregated by individual discipline. Maximum use of automation for repetitive routines, decentralized collaboration between units, and connectivity to widely dispersed maneuver elements are all critical components of a new architecture. Intelligence users must retain the capability to tailor the core intelligence picture to meet their own unique requirements, feed the core picture with "bottom-up" collaboration, and query the supporting intelligence network for greater *depth* of intelligence on the narrow *range* of subjects of interest to the local commander.

The Marine Corps can build on its existing systems and acquisition programs to achieve this distributed capability, and position itself to leverage emerging technologies in a coordinated manner. A distributed fusion network addresses not only the current shortfalls in our architecture, but also the challenges presented by emerging doctrines and technologies.

## *Glossary*

| | |
|---|---|
| A&P | Analysis and Production |
| ABCS | Army Battle Command System |
| ACE | Aviation Combat Element |
| ACHS | Army Common Hardware Suite |
| AFCS | Armed Forces Command and Staff College |
| APM | Assistant Program Manager |
| ARTDF | Advanced Real Time Data Fusion |
| ASAS | All-Source Analysis System |
| ATARS | Advanced Tactical Air Reconnaissance System |
| C2 | Command and Control |
| C4I | Command, Control, Communications, Computers, and Intelligence |
| CCE | College of Continuing Education |
| CE | Command Element |
| CGS | Common Ground Station |
| CI | Counter-Intelligence |
| CIA | Central Intelligence Agency |
| CINC | Commander In Chief |
| COBRA | Coastal Battlefield Reconnaissance Aircraft |
| COMINT | Communications Intelligence |
| CONOPS | Concept of Operations |
| CONUS | Continental United States |
| COP | Common Operational Picture |
| CSC | Command and Staff College |
| CTP | Common Tactical Picture |
| DARPA | Defense Advanced Research Projects Agency |
| DCGS | Distributed Common Ground Station |
| DCI | Director of Central Intelligence |
| DCIIS | Defense Counter-Intelligence Information System |
| DIA | Defense Intelligence Agency |
| DOD | Department of Defense |
| DOTES | Doctrine, Organization, Training, Equipment, Support |
| DHS | Defense Human Intelligence Service |
| DEA | Drug Enforcement Agency |
| DTES | Distributed Tactical Exploitation System |
| EA | Electronic Attack |
| ELINT | Electronic Intelligence |
| FMF | Fleet Marine Force |

| | |
|---|---|
| FSSG | Force Service Support Group |
| GCCS | Global Command and Control System |
| GCE | Ground Combat Element |
| GEOINT | Geographic Intelligence |
| HMMWV | High Mobility Multi-Purpose Wheeled Vehicle |
| HQMC | Headquarters Marine Corps |
| HUMINT | Human Intelligence |
| I&W | Indications and Warnings |
| IAS | Intelligence Analysis System |
| IMINT | Imagery Intelligence |
| IOC | Intelligence Operations Center |
| IOW | Intelligence Operator's Workstation |
| IPL | Image Product Library |
| IR | Intelligence Requirement |
| ISC | Intelligence Support Coordinator |
| ISR | Intelligence, Surveillance, and Reconnaissance |
| ITT | Interrogator Translator Team |
| JASA | Joint Airborne Signals Intelligence Architecture |
| JDISS | Joint Deployable Intelligence Support System |
| JFC | Joint Force Commander |
| JIC | Joint Intelligence Center |
| JISE | Joint Intelligence Support Element |
| JSIPS | Joint Service Imagery Processing System |
| JSTARS | Joint Surveillance Target Acquisition Radar System |
| JTT | Joint Tactical Terminal |
| JV2010 | Joint Vision 2010 |
| JWICS | Joint Worldwide Intelligence Communications System |
| LEO | Low-Earth Orbit |
| M&S | Modeling and Simulation |
| MAFC | Marine All-source Fusion Center |
| MAGTF | Marine Air Ground Task Force |
| MASINT | Measurement And Signature Intelligence |
| MCCDC | Marine Corps Combat Development Command |
| MCDP | Marine Corps Doctrine Publication |
| MCHS | Marine Common Hardware Suite |
| MCTSSA | Marine Corps Tactical Software Support Activity |
| MCU | Marine Corps University |
| MEB | Marine Expeditionary Brigade |
| MEF | Marine Expeditionary Force |
| MEU | Marine Expeditionary Unit |
| MIDB | Military Intelligence Data Base |
| MOS | Military Occupational Specialty |
| MOUT | Missions On Urban Terrain |
| MSC | Major Subordinate Command |
| MSTP | MAGTF Staff Training Program |
| MTI | Moving Target Indicator |

| | |
|---|---|
| NIMA | National Imagery and Mapping Agency |
| NIST | National Intelligence Support Teams |
| NITF | National Imagery Transmission Format |
| NPS | Naval Postgraduate School |
| NRO | National Reconnaissance Office |
| NSA | National Security Agency |
| OCAC | Operational control and Analysis Center |
| OMFTS | Operational Maneuver From The Sea |
| ORD | Operational Requirements Document |
| OSD | Office of the Secretary of Defense |
| PM | Program Manager |
| PMIC | Program Manager for Intelligence and Communications |
| POM | Program Objectives Memorandum |
| PPBS | Planning, Programming, Budgeting System |
| RMA | Revolution in Military Affairs |
| RRU | Remote Receiving Unit |
| SALUTE | Size, Activity, Location, Unit, Time, and Equipment report |
| SARC | Surveillance and Reconnaissance Center |
| SCAMP | Sensor Control and Management Platoon |
| SCI | Secure Compartmented Intelligence |
| SecDef | Secretary of Defense |
| SIDS | Secondary Imagery Distribution System |
| SIGINT | Signals Intelligence |
| SIO | Signals Intelligence Officer |
| SIPRNET | Secure Internet Protocol Network |
| SSU | Signals Intelligence Support Unit |
| TACSAT | Tactical Satellite service |
| TCAC | Technical Control Analysis System |
| TCS | Tactical Control Station |
| TDC | Tactical Data Correlator |
| TDN | Tactical Data Network |
| TEG | Tactical Exploitation Group |
| TERPES | Tactical Electronic Reconnaissance Processing and Reporting System |
| TFP | Tactical Fusion Processor |
| TPC | Topographic Production Capability |
| TRSS | Tactical Remote Sensor System |
| UAV | Unmanned Aerial Vehicle |
| UHF | Ultra-High Frequency |
| USMC | United States Marine Corps |
| VMAQ | Marine Electronic Warfare Squadron |

## *Bibliography*


Ackerman, Robert. "Balkans Serve as Proving Ground for Operational Imagery Support." *Signal*, October 1999, 17-19.

Cole, Maj Phil, USMC. CI/HUMINT Systems Project Officer at Marine Corps Systems Command. Interview by author, 14 September 1999.

Cukor, Captain Drew E., USMC. *Marine Ground Intelligence Reform: How To Redesign Ground Intelligence For The Threats of the 21st Century*. Master's Degree Thesis. Monterey, CA: Naval Postgraduate School, December 1997.

Ennis, Colonel Michael E. "The Future of Intelligence." *Marine Corps Gazette*, October 1999, 45-47.

Farmer, Maj Robert USMC. "Improving the Intelligence Analysis System." *Marine Corps Gazette*, April 1995, 35-38.

Field Manual (FM) 101-5, *Staff Organization and Concepts.* Washington, DC: Department of the Army. June 1995.

Glenn, Maj Ian, Canadian Army. Intelligence Requirements Officer, Canadian National Defence Forces. Interview by author, 17 August 1999.

Hirsch, Maj Chandler, USMC. Intelligence Requirements Branch, Marine Corps Combat Development Command. Interview by author, 3 December 1999.

Joint Publication. *Joint Vision 2010.* Washington, DC: Department of Defense. June 1995.

Joint Publication 2-0. *Joint Doctrine For Intelligence Support to Operations.* Washington, DC: Department of Defense. May 1995.

Lawlor, Maryann. "Today's Exploration Launches 2001: A Battlespace Odyssey." *Signal*, December 1999, 17-21.

Marine Corps Doctrine Publication (MCDP) 2. *Intelligence.* Quantico, VA: Marine Corps Combat Development Command. October 1997.

Marine Corps Research Center (MCRC)
Research Paper #92-0008. *Intelligence Operations in Southwest Asia*. Quantico, VA: MCRC, July 1991.

Marine Corps Systems Command. "Near Term Intelligence Systems Architecture (NTISA)." Unpublished research paper. September 1999.

Marine Corps Warfighting Publication (MCWP) 2-12. *MAGTF Intelligence Analysis and Production.* Quantico, VA: Marine Corps Combat Development Command. July 1999.

Marine Corps Warfighting Publication (MCWP) 2-15.2. *Signals Intelligence.* Quantico, VA: Marine Corps Combat Development Command. February 1999.

Operational Maneuver From The Sea (OMFTS) Working Group
Final Report. *21st Century Warfighting.* Quantico, VA: Marine Corps Combat Development Command, Autumn 1998.

Prueher, Joseph W. "Warfighting CINC"s in a New Era." *Joint Forces Quarterly*, Autumn 1996, 45-49.

Richards, Capt Larry, USMC. Imagery Intelligence Systems Project Officer at Marine Corps Systems Command. Interview by author, 29 September 1999.

Richelson, Jeffry T. *The US Intelligence Community, 3d ed*. Boulder: Westview Press, 1995.

Sander, Maj Emile, USMC. Doctrine Division, Marine Corps Combat Development Command. Interview by author, 14 December 1999.

Seffers, George I. "U.S. Army Intelligence Processing System Ready To Go." *Defense News*, 27 September 1999, 6.

Travers, Russ. "The Coming Intelligence Failure." *Studies in Intelligence Volume 40*, no. 2 (Spring 1996): 20-30.

Vickers, CWO Bruce, USMC. TERPES System Project Officer at Marine Corps Systems Command. Interview by author, 4 October 1999.